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UMAN AND BOVINE TUBERCULOSIS

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Bunn
L. E. BRUSH, M.D.

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THE ASSOCIATION

OF

HUMAN AND BOVINE

TUBERCULOSIS,

By E. F. Brush, M. D.,

OF

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PREFACE.

The following pages are devoted to the republication of some old papers presented to the medical profession during the past ten years. The reprint from the medical journals, from 5,000 to 7,000 of each, have been exhausted (as they were given away). Requests for some of the articles are still coming in; hence, the reproduction in book form. There is no claim that these magazine essays are of sufficient importance to be preserved in a bound volume; but as the subject-matter is one that is now attracting, as it deserves, an increased public attention, it may be that some of the arguments and alleged facts here presented may be deemed worthy of controversy, and thus lead to the truth, which has been one of the desires of the author.

Mount Vernon, N. Y., April, 1898.

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BOVINE TUBERCULOSIS.*

After passing through the various controversies regarding gray tubercle, yellow tubercle, giant cells, scrofulosis, etc., at the present time we find the question of tuberculosis narrowed down to bacillary infection, and we are confronted with the inquiry, "Is bacillary tuberculosis conveyed to the human race from animals affected with this disease?"

All civilized races on the face of the globe have surrounded themselves with domestic animals. We have the horse, the pig, the sheep, the goat, the dog, the cow, and others. Of these we find that the horse is entirely exempt from tuberculosis. The sheep, the goat and the dog are not found in nature affected with this disease, and they likewise resist artificial infection well; under certain condition the pig takes on tuberculosis; it is, in fact, from this animal that we get our word scrofulosis. But, as we find them at the present time, they are not tubercular, because in this animal in-and-in breeding, which favors the

*Read before the Medical Society of the State of New York, February 7, 1888. Reprinted from the New York "Medical Journal."

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development of tuberculosis in all creatures prone to this affection, is not profitable to the breeder, as swine animals of close consanguinity fail to have young as a rule, and, if they do, the offspring dies soon after birth. Thus breeders are careful to put sows to boars not at all related, and we find the pig of the present day remarkably exempt from scrofulosis. The only reliable statistics to which I have access are some compiled in Bavaria in 1879. According to these, of 66,403 animals slaughtered for food, only two swine were found to be tubercular. When, however, we come to the bovine race, we find among these domesticated animals always a certain percentage of them affected with tuberculosis in its various forms. In fact, this race and the human are pre-eminently tubercular. In all the experiments of the present day, whether inoculation or cultivation, matter from either the human or the bovine race is used; and the question *pro* and *con* relating to the contagiousness of this disease lies between these two races. Of all the domesticated animals known, none is so intimately or closely related to the human race as the cow. We are veritable parasites on this animal. We milk her as long as she will give milk, and we drink it; then we kill her, eat her flesh, blood, and most of the viscera; we skin her, and clothe ourselves

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with her skin; we comb our hair with her horns, and fertilize our fields with her dung, while her calf furnishes us with vaccine virus for the prevention of small-pox. Strange it would be, indeed, if, under all these circumstances, we did not acquire from her some malady; she has tuberculosis, and we have tuberculosis; certain it is she does not acquire it from us. Artificial inoculation of tubercular matter from the cow in very many cases tubercularizes other animals, and, by the success of many of these experiments, scientific men have, many of them, been excited into becoming alarmists, and have appeared before the world in print with sweeping and startling assertions, but have failed to attract the attention they deemed their alarms entitled to.

The question of the contagiousness of the disease under consideration is an old one. Morton, writing 200 years ago on consumption, says: "This disease is also propagated by infection, for this distemper, as I have observed it by frequent experience, like a contagious fever, doth infect those that lie with a sick person with a certain taint." Although this statement has been reiterated, and many of us have become convinced from our own experience, few believe that it is contagious among the human race. At a recent meeting in England, when the question

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was under discussion, Dr. Henry Bennett exclaimed: "Such a theory is dangerous, because, if it were true, the disease would be worse than the plague, and each tubercular patient would have to be treated as were the lepers of old." This is a queer statement, and evinces in a certain degree human perversity. I do not know what there is about this disease which fails to alarm the human race; it is contagious, insidious, deceitful and destructive. Men afflicted unto death are seldom or never convinced that they are dying. As illustrating this strange human fallacy, we notice that at one time in Germany the name for tuberculosis in cattle was *Franzosenkrankheit*, the then popular name for syphilis, and hence for a long time the flesh of animals thus diseased was not eaten in that country; but when they found that the disease was simply tuberculosis—an affection that kills a far greater number than the other disease—they fell to eating the meat again, just as we do.

Virchow says: "Man is far more susceptible to the diseases of animals than the latter are to similar diseases from man." Now, if Virchow is right, and he generally is, the question arises, Why are not more of the human race tubercular, as we find a certain percentage of all cows that furnish milk and meat to the human race are

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tubercular? Fleming reckons that 5 per cent. of all the bovines in England are infected. We have no complete statistics on this matter.

I have been told by inspectors of the Bureau of Animal Industry that a much larger percentage of our cows are affected. Indeed, among the thoroughbred Jerseys in the northern States 20 per cent. are affected, as I have been told by Professor R. A. McLean, the chief of this district from the bureau. Now, with this large percentage of tubercular cows, and assuming that it is a fact that tuberculosis is communicated from the bovine to the human race, and considering our close relationship to the animal, why are not more of the human race killed by this disease?

The total number of cows in the United States for the year 1887 was 14,522,083 — that is, one cow to every four and three-tenths (4.3) persons. There exists, according to Lynt, a true parallel between bovine and human phthisis; the curves of double mortality are the same for different districts in the Duchy of Baden. Now this must mean that a larger proportion of the bovine race dies from phthisis than of the human race, because of the difference in the length of life between the races. We have no statistics of this kind in the United States, but Professor R. A.

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McLean, the authority before referred to, tells me that where cows are affected by tuberculosis in great numbers, the death-rate from phthisis is correspondingly large in the human race in the same districts. This is his observation from his large experience among diseased cattle.

Now let us see what the conditions of the two races are, how they differ, and how this difference modifies the disease under consideration. Without going into detail in comparing the two, you will find, after due comparison, the most marked difference to be that of the normal temperature of the two races, and this difference you will at once concede is of more effect in relation to the disease than any of the other conditions. Many years ago I made an attempt to discover the true normal temperature of the cow by thermometric observations of large herds in the field, and became completely puzzled at the lack of uniformity and the very high average. I then searched my books for some authority on the subject, and found a lamentable ignoring of the whole question in many works relating to bovine pathology. The only allusion I could find was in Steele's work, which, while excellent in some other respects, simply quotes bovine temperature from Armatage, and this quotation was in turn a quotation from an English book out of print, the

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name of whose author was not given. These quoted temperatures (100.9° F. to 101.9° F.) are much lower than the results of my observations, and the differences I observed in the range were far greater. I have found cows in apparently perfect health with a temperature of 103.5° F., and ranging from that down to 101.2° F. From my own observations among cows and the experience as given in books, I find that all the animals endowed with hairy and woolly coats, but without well-developed sudorific glands — that is, that do not sweat readily — do not maintain a uniformity of temperature. The difference between a quiescent condition and one of activity is several degrees without affecting the health. But all these animals have a higher range of temperature than the human species. Thus we find in the published tables the following figures:

Cows and oxen during confinement, 100.8° F.; during work and liberty, 101.8°; calves and stirks during confinement, 100.9°; during work and liberty, 101.8°; sheep during confinement, 102.5°; at liberty, 104.5°; lambs at liberty, 104.9°; pigs in confinement, 101.6°; at liberty, 103.2°; dogs in confinement, 99.3°; at liberty, 101.9°; and horses in confinement, 99.2°; at work and liberty, 100.3°; rabbits, 103°; guinea-pigs, 102°; the common fowl, 106.7°.

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Now, if you compare this table with all the recent inoculation experiments on bovine tuberculosis, you will find that the success of such experiments is in direct ratio with the temperatures — that is, commencing with the lower temperature, that of the dog, we find the resistance lessening as we go up the scale till we come to the common fowl, with the highest temperature, where there is no resistance whatever. Feeding with tubercular matter is always positive with this bird.

We can now see why the human race is not more extensively affected with tuberculosis, which, in my candid opinion, is all derived from the bovine race. A germ cultivated in the cow is a tropical growth, because her average temperature is between 101° and 103° F. The human race, by this mode of illustration, represents the temperate zone. Coffee will not grow in Connecticut unless you put it in a hot-house. Ringer, in his valuable little monograph on the temperature of the body as a means of diagnosis and prognosis in phthisis, states that in acute cases the temperature of the human body rises daily to a high point — 103° to 105°. Further, a patient in previous good health is seized with pretty copious and repeated haemoptysis; there are no physical signs, and beyond a cough and

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an elevated temperature of 102° or 103° F. there is no evidence of phthisis. These symptoms are, however, sufficient to declare the nature of the case. Thus you will see that the temperature, as cited here by Ringer, is about the normal temperature of the bovine race. Ringer further says: "Thus, in all cases observed in which the deposition of tubercle was going on there was a continual elevation of the temperature, while in those cases in which the deposition had ceased the temperature was normal." To quote further from Ringer, whose testimony is valuable on this point: "Thus we meet with cases of phthisis accompanied with elevation of temperature during several weeks before we get physical signs indicative of the deposition of tubercle." Now, although Ringer does not draw such a conclusion from this fact, the interpretation is plain to me that from some cause or other the temperature was increased to the right degree to start the growth of the *bacillus tuberculosis*, which, when well started, like all other ferments, had the power of keeping up the temperature by its own activity. That is, the temperature has been increased to the proper degree to permit of the growth of the bacillus, and the deposition of tubercle is simply the result of the multiplicity of bacilli creating for themselves places of congre-

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gation. At least, I take it that this is the true relation of the germ to the tubercle. The germ does not kill directly, but an aggregation of the bacilli surrounded by the new growth is the tubercle, and when the tubercle is formed the germ has finished its activity; and, if this new formation becomes organized or certified, death does not result, but if the tubercle, that has been formed simply as a resting-place for the bacillus, breaks down, death results from sepsis.

These facts relating to temperature also illustrate localized deposits of tubercle from traumatism. Thus, a human body in which the bacilli are already present, but not growing for lack of temperature, finds it proper conditions where the temperature is raised by reason of the injury, as traumatisms always produce local inflammatory action. If this theory is accepted, the argument regarding the scrofulous origin of joint diseases becomes superfluous; both parties, in fact, have been right. In further proof that a high temperature is necessary for the growth of the *bacillus tuberculosis*, the late Dr. Flint, in his valuable work on practice, says: "I do not hesitate to express the belief that in a certain proportion of cases alcohol exerts a curative influence in pulmonary phthisis." Wunderlich, in his valuable book on "Medical Thermometry," writes: "In

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febrile conditions the effect of alcohol is to lower the temperature." He also says: "Habitual drinkers have, as a rule, under parallel circumstances, a lower temperature than other persons."

Not only does temperature play an active part in the creation of tuberculosis as a disease, but we find that in cultivations outside of the body it requires a nicer adjustment of temperature than any of the other germs.

In regard to the role played by the temperature in the disease under consideration, we have a very interesting experiment of Toussaint's. He extracted some juice from the lung of a tubercular cow; some of this virus he injected into a pig and two rabbits; then he heated in a water-bath part of the same virus to a 130° and 137° F. for ten minutes, and injected the virus into four hogs and four rabbits. He says general infection occurred very rapidly in all these animals. Curious to state, the rabbits that had been inoculated with the heated liquid died before the others.

The only cited experiment that I can find where tuberculosis was conveyed directly from the bovine to the human race I clipped from the New York "Medical Record" some years ago: "Two Greek physicians inoculated a patient who was dying of gangrene of the leg with tubercular

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matter from a cow. They state that the patient's lungs were healthy prior to the inoculation, and at the autopsy there were well-marked tubercular deposits in the lungs." If this is an authenticated case, which, of course, I cannot affirm, there was undoubtedly the proper temperature for the growth of the germs, and hence the success of the experiment.

My occupation brings me into close contact with dairy cattle, and I have therefore been compelled to devote my attention to the subject of the diseases afflicting dairy stock. That there is a large number of dairy cows afflicted with tuberculosis I can affirm; that there has never been an attempt to exterminate this disease is a fact of which I am also cognizant. Last year the Federal government appropriated half a million dollars to stamp out zymotic pleuro-pneumonia. This disease does not affect the human race, as no other animal except the bovine has ever been known to suffer from it. It affects the pockets of the cattle-dealers grievously; but the health of the general public is not threatened by it, while bovine tuberculosis, which the government inspector finds coincident with a high death-rate in human phthisis, is left uncontrolled. Cattle-breeders everywhere have unrestrictedly followed the homicidal practice of in-and-in breed-

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ing of dairy stock. This method of breeding we all know favors the development of the disease, and the development of this disease in the bovine race simply means more phthisis in the human race. One simple fact that strengthens my belief that human bacillary tuberculosis is all derived from the bovine species is, that where this animal does not exist, pulmonary consumption is unknown. The Kirghis on the steppes of Russia, who have no cows, have domesticated the horse, using its milk, meat and skin, and a case of pulmonary tuberculosis has never been known to exist among the tribe. The Esquimau has no cows, neither has he pulmonary phthisis, and I think it can be laid down as a fact that where the dairy cow is unknown pulmonary consumption does not prevail.

Among the numerous statistics giving the occupation of those persons who die of bacillary phthisis, I do not find the occupation of a farmer included; my own observations in farming districts convince me that large numbers of these people die of lung tuberculosis. That these people are in greater danger of infection from milk from tubercular cows is evident from the fact that they very often drink the milk "warm from the cow," while the city consumer almost

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always gets his milk after it has been chilled, and all the cultivation experiments go to prove that this germ will not grow at a temperature of less than 87° F. The reason why these farmers' deaths are not included in statistics is due to their remoteness from the great centers where the statistics are collected.

The cow has redeemed us from one dreadful scourge, small-pox. I am, however, inclined to think a greater scourge is continued to us by the same animal. It is the deceitfulness and insidiousness of this disease that lure us into a quiet state. Bacillary infection is not rapidly fatal as a rule; the infection received into the system of a human being lies in wait for a proper condition of its host before it can assert its sway, and, if the opportunity never occurs in the individual originally infected, the infection is continued to the offspring, and the wasting bacillus finds its opportunity some time. Men never know when they receive the infection that results in a fatal attack of pulmonary phthisis.

We long ago acknowledged our inability to check this scourge when it has once got its insidious grip on a human creature. Certain cases do end in recovery, but under circumstances that thus far we have been unable to comprehend; we have no known methods of successful treat-

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ment. Let us then, as medical men, turn our attention to prophylactics.

There is no good reason why we cannot be instrumental in passing laws to regulate the breeding of dairy-stock. The disease is well marked; therefore, there would be little difficulty in selecting animals afflicted and excluding them from the dairy and butchers' shops, and in indicating to our legislators the necessity of passing laws to prevent the breeding together of tubercular animals, or the in-and-in breeding of any of the bovine species. Let us treat this disease, especially among the cows, as leprosy was treated of old, and then we shall be saved from the painful necessity of treating the human race in like manner, for I am convinced that, if we stamp out tuberculosis in the bovine race, a few generations will eliminate it from the human family.

Since the presentation of my paper, I have received numerous inquiries respecting the diagnosis of tuberculosis in the cow. One country practitioner says he never saw a milch cow with tuberculosis, and could not understand how the disease could be so prevalent and yet not be more apparent.

Tuberculosis is emphatically a bovine disease; this race can be tubercular from birth to old age, and yet not die from this disease. It is only when

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the surroundings, lack of care, and other bad hygienic conditions lower the resistance that caseation of the tubercular mass takes place, and the animal dies from sepsis.

The diagnosis of tuberculosis in the cow is just as simple as in the human family. We recognize in this latter the general appearance of an individual with a phthisical habit, or scrofulous; and in the same manner, after becoming familiar with the disease in the cow, one recognizes a suspicious appearance, which requires to be verified by percussion and auscultation.

The prominent sign of a suspicion of tuberculosis in the cow is an enlargement of the inguinal gland. Coincidently with the deposition of tubercular matter in other locations there is a marked tendency of the lymphatic glands to become focuses of infection. These glands are usually infected in groups, those of the larynx, pharynx, trachea, lung and heart, the abdominal and the *inguinal.* It is the enlargement of this last-named gland, which can be so plainly observed even by a casual examination, that indicates a tubercular condition. I never have seen a tuberculous cow without an enlarged inguinal gland. Of course, this gland may become enlarged from other causes; but just as we feel for an enlargement of the post-cervical glands in a

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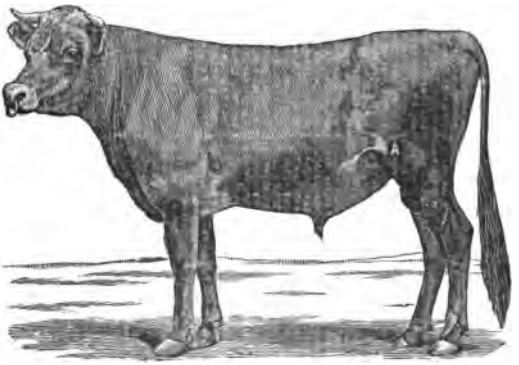
supposed case of syphilis, so the enlargement of the inguinal glands in the cow must be looked for, and they are just as strong a diagnostic indication of tuberculosis in the bovine race as the post-cervical glandular enlargement is of syphilis in the human race.



The first illustration is one that I have had engraved from a photograph, and shows this enlargement. You will notice a prominence just in front of the letter A, on the animal's thigh. The history of this case may be interesting as illustrating the diagnostic value of this glandular appearance. Last winter, a doctor, a friend of mine, was showing me a number of photographs of famous cattle, among which was the one from which this engraving is taken. The

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general appearance of this bull, together with the prominent appearance of the inguinal gland, at once attracted my attention, and I said "This is a tuberculous animal." The possessor of the picture smiled at my suspicion; nevertheless, he lent me the picture, as I told him I knew the purchaser of this bull, and therefore could learn from him all about the animal. A few days later I met the gentleman who had had charge of the herd to which the bull belonged, and obtained from him the following statement: The bull was bought in France for a very large sum of money, because he was so closely inbred as to have a larger percentage of the famous Cobmassie blood than any other animal living at that time. He was used for a short time in the herd for which he was purchased, and then was sold at auction, bringing a price numbered in the thousands of dollars. He was sent West, where his purchaser lived, and he, in order to get back his money, allowed the bull to serve a large number of cows shortly after his journey. Then the bull *caught cold* and died. No suspicion of tuberculosis was ever entertained, although the narrator of the foregoing history replied, in reference to one of my remarks: "It always seemed to me a very funny circumstance that a bull, used to ordinary stabling, and its accompanying draughts, should

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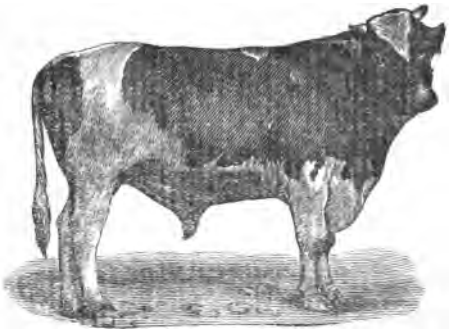
catch cold in July, in haying-time, and die from such a cold."

The second illustration is from a photograph of the chief bull of my herd, a Holstein, bred by William M. Singerly, of Philadelphia. In his breeding, there is not a single repetition of an animal as far back as his pedigree goes in the "Holstein Herd Book;" none of his progenitors were at all related. You will observe how much



larger, stronger and rugged his appearance is than that of the tuberculous Jersey. The difference in the formation of the chest and shoulders is well marked, and, as the engraving shows, there are no indications whatever of glandular enlargements. I introduce these engravings to illustrate two distinct types — first, an inbred tuberculous animal, and secondly, a rationally bred, healthy, robust animal.

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[Reprinted from The New York Medical Journal, June 15, 1889.]

THE RELATIONSHIP EXISTING BETWEEN HUMAN AND BOVINE TUBERCULOSIS.*

A strangely interesting phase of the study of phthisis is that presented by the disease in living beings. In the human race the afflicted are generally the most attractive members of society. Scrofulous females are usually among the most beautiful people we meet, with their transparent complexion and large languid eyes, while the scrofulous males are either intensely intellectual or correspondingly erotic. The same rule holds good in the bovine race; the small inbred tubercular Jersey is in appearance the most attractive of any of the cow tribe, while even the common scrub cow that is tubercular has a certain beauty that distinguishes her from her more robust sisters. I know a famous animal painter who will always unconsciously select from a herd of cows the scrofulous one for his study whenever he makes a study of a single animal from a herd.

* Read before the New York Academy of Medicine, April 18, 1889.

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This is not the only strange feature of the disease. No one seems to be afraid of it. For years men of undoubted scientific ability have been proclaiming to the world the still hardly recognized fact that bacillary phthisis is contagious, but the human family take little heed. Furthermore, the individual, sorely afflicted, beyond human aid, and shortly to die, is not convinced of the fact, but, with the same strange fatality that surrounds the disease in all its phases, the consumptive is still hopeful and imagines he is getting better even while he is dying.

This insidious and delusive disease is not the result of civilization, as many suppose. Barbarous and uncivilized races are afflicted as severely as many of the most advanced civilized races. Neither geographical position nor climatic conditions are a factor in the distribution of pulmonary phthisis, notwithstanding that our best workers in the study of the disease attempt at times to account for its prevalence in certain localities by reason of temperature or other climatic conditions. Nevertheless, every known part of the globe, with a few isolated areas excluded, is a habitat of the disease. After several years of close study of the affection, and consulting all accessible statistics and the habits of the people where the disease prevails, the only constant as-

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sociated factor is found, in my opinion, in the inbred bovine species, without any regard to the social position of a community, its geographical habitation, terrestrial or atmospheric condition. If a community is closely associated with inbred dairy cattle, tuberculosis prevails.

This position which I take is susceptible of strong proof.

In establishing my proof I will first draw your attention to some barbarous races of Africa. Speaking of the natives of South Africa, P. L. Simmonds, in his book on "Animal Products," says: "This people delight in horned cattle of the bovine species," "the natives are great milk drinkers," "these barbarous people suck the blood from the jugular vein of the living bullock," and also "churn together blood and milk for a drink." Professor Low, in his "History of the Ox," tells us: "In the vast regions of southern Africa, peopled by tribes of warriors and herdsmen, cattle abound and multiply, and form the wealth of little communities. The Hottentots, while yet they had a country they could call their own, were rich in this kind of possession." In Hirsch's book on the "Geographical Distribution of Phthisis" we find the following: "In Cape Colony phthisis is oftenest met with among the Hottentots inhabiting the plains near the

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coast." In proof of the fact that these African cattle are inbred, we have the writings of Anderson, quoted by Darwin as follows: "The Damaras take great delight in having whole droves of cattle of the same color, and take great pride in their oxen in proportion to the size of their horns. The Namaquas have a perfect mania for a uniform team, and almost all the people of southern Africa value their cattle next to their women, and take great pride in possessing animals that look high-bred." Darwin, from whose "Animals and Plants under Domestication" we take this quotation, adds in his own words: "As numerous breeds are generally found only in long-civilized countries, it may be well to show that in some countries inhabited by barbarous races, who are frequently at war with each other, and therefore have little free communication, several distinct breeds of cattle now exist, or formerly existed, at the Cape of Good Hope. Lignat observed in 1720 three kinds; at the present day (1868) various travelers have noticed the difference of the breeds in southern Africa. Sir Andrew Smith several years ago remarked to me that the cattle possessed by the different tribes of Kaffirs, though living near each other under the same latitude and in the same kind of country, yet

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differed, and he expressed much surprise at the fact." *

These facts relating to the cattle-breeding propensities of the negroes account for the statements of Daniell, that "phthisis is widely prevalent and very malignant among the negroes of the west coast of Africa." In the interior plateaus of southern Africa phthisis, however, hardly ever occurs. This immunity can be accounted for by the presence of the tsetse fly. This fly inhabits well-defined regions in central Africa, and where it exists, cattle, horses, and dogs can not live.†

Let us now take the civilized inhabitants of a colder clime, and we find that in Denmark, one of the noted dairy countries, there are 1,470,078 cows to 2, 033,959 inhabitants, or one cow to 1 5-14 inhabitant. The mortality from phthisis in that country ranges from three in a thousand, to 2.1 in a thousand. Now Iceland, an island belonging to the King of Denmark, where the climatic conditions are nearly the same, has 20,000 cows to 80,000 inhabitants. There are no definite statistics about this, but, taking the most

*Guiol says that consumption is not uncommon among the colored races, particularly the Kaffirs. Guiol, "Archives gén. de médecine," November, 1882, p. 329.

†Wallace, "The Geographical Distribution of Animals," 1876, vol. 1, p. 945.

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trustworthy accounts of the island as a guide, this is about the condition of affairs. The people of Denmark are well-to-do, and can use for themselves more of their dairy productions, while the poor Icelander pays his rent with his dairy product. With the exception of milk, the Icelander uses very little from his herd for food. In several accounts of travelers in that country giving a description of the entertainment extended to them, I never find beef in a single instance, while in the winter nearly all the milk used is obtained from the sheep. Owing to the short hay crops, the cows are fed in winter on dried fish, and consequently the cattle will not give milk on the same low diet as the sheep do. With all these modifying influences, and only one cow to four individuals, the rarity of phthisis in the island can be accounted for, if my theory is correct. That the disease is rare we know from the writings of Schleisner, who says: "According to the unanimous testimony of practitioners on the island, consumption does indeed occur there, although remarkably seldom. In my own practice I have most carefully examined every patient who complained of even the slightest trouble in the chest, and out of 327 persons suffering from chronic diseases of the organs of respiration, I found only three with phthisis." Evans says that "this

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statement is borne out by the more recent writings on the state of health in Iceland, by Leared, Hjaltlin, and Finsen. It would appear that it is not with any national peculiarity that we have here to do, from the fact that Icelanders who migrate to Denmark fall into consumption not infrequently." *

Now let us look into the affairs of a little island in the Atlantic Ocean as they existed 68 years ago. It will be remembered that in my former paper on this subject I made the statement that asses and goats were not tubercular animals. The following is quoted from "A Description of the Island of Saint Michael," by John W. Webster, M. D., 1821: "Every family in Saint Michael has one or more asses, which are the principal beasts of burden in common use, subsisting on the coarsest kind of food; the females afford considerable milk, which is sold to sick persons. Although the island is so well stocked with black cattle, sheep, and goats as to allow considerable exportation, few of these belong to the peasantry. Cows are mostly attached to the estates, and the peasant who hires a farm, in addition to a certain quantity of work to be performed for his landlord, is required to take charge

* Hirsch, "Handbook of Geographical and Historical Pathology," 1886, vol. iii, p. 177.

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of these, and convey the milk, butter, and cheese to town, where they are sold for the benefit of the *morgado*, and the poor peasant receives no other recompense for his trouble than some slight abatement in his rent. The milk is carried to town in skins, on the backs of asses, but, from the agitation it undergoes, on its arrival most of the families in the city prefer using the milk of the goats, herds of which are kept in the vicinity, and daily driven into town and milked at the door of the customers." Dr. Webster adds: "Although the climate of St. Michael can not be safely recommended to a consumptive patient, it is, nevertheless, rare to see the disease in a native." Dr. Webster would not have been astonished at this condition of affairs had he realized the truth that phthisis is a disease acquired from the bovine race, for it is a fact that the only people on the face of the globe who enjoy an absolute immunity from phthisis are those who are not in possession of the domestic cow. Take, for instance, the Kirghiz on the steppes of Russia; these people consume large quantities of mare's milk and eat the flesh of horses and sheep; but they have no cows. According to Dr. Neftel and other authority, a case of phthisis among these people was never known.* Likewise, the Es-

* Maydell, quoted by Williams.

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quimaux also enjoy immunity, because they have domesticated the reindeer, not the cow.

But this allusion to the Esquimaux does not apply to those who inhabit Greenland and that part of the Danish dominions in the Artic region. There are Esquimaux that know not the cow and there are Esquimaux who have domesticated the cow. So there are authorities that state that the Esquimaux are exempt from phthisis, and other authorities equally as positively state that "consumption is common" * among them. Thus, in the government list of mortality for the province of Julianshaab, "forty-six persons died (out of a population of 4,115, Esquimaux and mixed breeds) of diseases of the chest, which include phthisis, pneumonia, bronchitis, pleuritis, etc." † This prevalence of tuberculosis is perfectly explained by the facts given in Dr. Hayes's book, "The Land of Desolation." ‡ He writes in his visit to Julianshaab: "Around the lake were extensive pasture grounds, upon which were browsing a herd of cows... At this I was not a little surprised, for, although I knew that in former times cattle had been reared here in great numbers, I had received the impression that at the present

*Williams, "Influence of Climate in Pulmonary Consumption," p. 17.
† Ibid., p. 16.
‡ Dr. Hayes, "Land of Desolation," p. 36.

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time they would not thrive. Mr. Arthur informed me there was no difficulty in raising them, except the very important one of forage for the winter, for at Julianshaab the grass never grows high enough for hay; further up the fjord, however, it is abundant. But since the hay must all be brought in boats, it was both a tedious and expensive operation to gather it. Yet he managed to keep three cows, the governor had an equal number, the doctor had two, others had each one; and, indeed, all the well-to-do people in the village—Danes, half-breeds, and the better class of Greenlanders—had a daily supply of milk the year round." Therefore, according to this testimony, the average of dairy cattle in this community is higher than in many better-known localities, and the prevalence of phthisis is not at all surprising.

Now let us look at a locality which once enjoyed immunity but now is notoriously a place for consumption. Wallace, in his work on "The Geographical Distribution of Animals," tells us that Australia was the poorest zoological region on the globe. A story is told by Simmonds as follows, which illustrates the scarcity of animals in this region: "Mr. Oldfield, who has seen so much of the aborigines of Australia, informs me that they are all very glad to get a dog, and several

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instances have been known of the father killing his own infant in order that the mother might suckle the much-prized puppy." The only animals that existed in this island before its invasion by Europeans were, according to Wallace, a few marsupials. Previous to 1788 no ruminants existed in Australia. In that year 1,030 convicts and sailors were landed; they had with them as public stock one bull, four cows, one calf, one stallion, three mares, and three colts. In 1790 provisions gave out, and they were obliged to kill all the live stock they possessed. In 1796 two bulls and three cows of the Cape of Good Hope breed were introduced, but they escaped and fled into the interior, where they were lost for several years. During this year several attempts were made to introduce European cattle, but they all died on the passage. In 1807 the Government had a herd of cattle in the colony, and cows were worth $400 a piece. In 1821, the government becoming convinced of the great advantages of Australia as a grazing country, emigrants were allowed a grant of from 500 to 2,000 acres of grazing land, and rations from the King's stores were also allowed to each settler; a certain number of convict servants were likewise apportioned to them. They were also allowed a certain number of cattle from the government herd, and a

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loan of money to be repaid in seven years. This was the beginning of the cattle raising in Australia. It proved so successful that in 1826 the Australian Agricultural Company commenced its operations, which was the origin of the "*sheep and cattle mania*," and, as the historian puts it, "the priest forsook his altar and became a herdsman of cattle." A drought, beginning in 1827, and lasting for three years, cured the mania. But within a year after the drought, cattle became so plentiful that the meat of the best quality was sold at a cent and a half a pound. In 1833, good cattle could be bought for $4 or $5 a head. At the present time, or according to the last consular reports, there are 3,000,000 inhabitants and 8,000,000 cattle—nearly three animals to each individual. This great increase will be seen by the foregoing to have taken place within 60 years. Australia enjoyed a reputation for immunity from consumption, and the favorable influence of its climate on the course of the malady, but, as Hirsch says, "this has of late been shown to be a mistake. In Victoria," he continues, "where the disease, it is true, has been a good deal more common *only in recent years*, the mortality from phthisis in 1866, was 6 per cent. of the mortality from all causes, while in Melbourne itself, the death-rate rose between 1865 and 1869 from 2.22

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to 2.52 to a thousand of the population. In New Zealand phthisis has made frightful ravages among the Maoris, and has been one of the chief causes of the gradual extinction of that race." In my opinion, the death-rate from phthisis will keep on increasing in that locality if the breeding of cattle is not properly regulated by law. We know from other historical facts that cattle can be raised without this great danger, because Hirsch and others tell us that in the Hebrides,* the Highlands of Scotland, and North Wales consumption is remarkably rare. The rarity of the disease in these localities is accounted for by Darwin's observation while he was studying the conditions of cattle under domestication. He says: "So with the mountain cattle of North Wales and the Hebrides it has been found that they could not withstand being crossed with the larger and more delicate lowland breeds. Our *improved* heavy breeds of cattle could not have been formed on mountainous pastures." Now, any one who has paid much attention to the history of cattle breeding knows that the improved races, as we understand them, are the result of the closest inbreeding. The rarity of the disease in mountainous countries also explains the following quotation from Hirsch: "Few countries

* MacCormac, "Brit. Med. Jour," 1868, ii, p. 571.

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of Europe enjoy, on the whole, so favorable conditions as Switzerland in respect to the infrequency of consumption, the figures for the entire country, according to Muller, being 1.86 in a thousand. In studying, however, the statistics of the different cantons, we find the mortality ranging from 3.57 to only 0.81. We know that there are localities in this mountainous country where Darwin's observations respecting mountain breeds would explain this condition of facts. The number of cattle in Switzerland is 1,210,849, and the population, 2,906,750, or one animal to 2 4-29 inhabitants. Of course, too, there are regions of Switzerland where only the goat can range. We find from the official returns* of 1866, that there were 375,482 of these animals in that country, and we know, from the reports of travelers,† that the milk from the goat is used exclusively in some localities.

Having considered the conditions of some barbarous and some civilized communities, let us now look at the semi-civilized tribes of Madagascar. Both Hirsch and Evans,‡ quoting Grenet, say that in this island consumption is as common as it is in any part of Europe, and rapidly fatal. We have no statistics of the numbers of the popu-

* Simmonds, "Animal Products," p. 56.
† Prime, "Letters from Switzerland," p. 44.
‡ Hirsch, *op. cit.*, vol. iii, p. 186.

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lation or of the cattle, but all the writers who have visited the country speak of the enormous herds of cattle, and say that the principal diet of the natives is meat, milk, and rice. The principal occupation of the Malagasy is the raising of cattle, thousands of which are shipped to the other islands in the Indian Ocean. In fact, the Island of Mauritius, with its mixed inhabitants, depends entirely on Madagascar for its meat supply. The Rev. William Ellis, describing his trip from Tamatave on the coast to the capital, a distance of about 300 miles, tells of the natives presenting him, at the end of every few miles' journey, with a bullock, while the Queen herself, as a token of friendship, presented him with eleven. He also adds that the natives never skin their animals, but cut them up and eat the hide as well as the meat.

We have well-authenticated statements respecting another semi-civilized race, the natives of Great Kabylia, who, according to Hirsch and Evans and other authorities,* enjoy an almost absolute immunity from phthisis. According to the best authorities I could consult as to the history of the people, there is no evidence of the presence of the bovine tribe among them, but

* Armand, "Méd. et hygiène des pays chauds," Paris, 1853, p. 375. Bortheraud, "Méd. et. hyg. des Arabes," Paris, 1855.

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they possess large flocks of sheep and goats, and each family has usually one buffalo ox to do the plowing.* As these are a peculiar people, with peculiar ideas and peculiar habits, not calculated to encourage visits from European invalids, they retain their immunity from phthisis to the present day. But not so with their neighbors, the Algerians. This country, having been occupied for over half a century by the French, has been therefore rendered sufficiently civilized to offer an asylum for European invalids. When first occupied by the French, the country was exempt from phthisis, and, of course, the publication of this fact drew to it many consumptive invalids. The dairy cow was unknown in Algiers before the French conquest. There were innumerable herds of buffalo, indeed; but the French in vain offered a premium of fifty francs a head for the importation of dairy stock.† Up to 1854 they were unsuccessful, all these attempts proving futile. In the latest statistics from that country we find the largest proportion of deaths from phthisis among the European civil residents.‡

Dr. Scoresby Jackson makes the following remark about Algiers: "It is not necessary to

* Daumas, "La Grande Kabylie." Morell, "Algeria," 1854.
† Morell, "Algeria," p. 477.
‡ Jackson, "Medical Climatology," p. 138.

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prove the absence of pulmonary consumption from the natives of a country in order to demonstrate the beneficial influence of its climate upon those so affected from other countries. It would be difficult to find such a place, . . . but Algiers, at all events, approximates such a condition."

There are many other countries furnishing statistics of death-rate from phthisis where the disease is not indigenous but due to importation. I think this can be said of Greece. According to Roser* and Olympios, the disease is very rare in that country, and Edmond About, in his book on " Greece and the Grecians," tells us that " the town of Athens possesses only five or six cows; no other milk is drank than that of the sheep; their butter alone is eaten. They eat meat but once a year. The entire population eats meat at Easter for the whole year, † and this meat is lamb.

In studying the relations existing between the human and the bovine races I find that religion plays a prominent part. Thus, in India, with the Mohammedan, Brahmin, and Buddhist religions, but where, as a rule, dairy cattle have not been

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*Roser, "Ueber einige Krankheit. des Orients," p. 79. Olympios, "Corresp. bayerischer Aerzte," p. 181.

†Edmond About, "Greece and the Grecians," p. 33.

‡ *Ibid.*, p. 102.

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domesticated, there was undoubtedly an absence of phthisis before the English occupation. Hence, to-day we find all statements regarding the presence of tuberculosis uncertain. Thus Hirsch* says: "So also in India the prevalence of phthisis can not be given in figures. It is, on the whole, rarer in that part of the world than in the temperate zone of the Eastern Hemisphere, but by no means so rare as the earlier observers supposed from their imperfect means of diagnosis." Now, here is that expression of the feeling of doubt and uncertainty which we find in many works relating to this elusive disease. A man of scientific ability goes to a country and finds no phthisis among the inhabitants. After some years, under circumstances that change the habits of the people, he begins to find phthisis, and therefore imagines he was mistaken in his first observations. We find this taking place in Australia, Algiers and Greenland. In India this vacillating expression of doubt is easily accounted for. When the English first occupied the country, the only cow they had was the small Hindoo variety, not related to our dairy cow, and this animal was and is an object of veneration, and the milk used in the country was derived from

* Hirsch, *op. cit.*, vol. iii, p. 185.

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the buffalo. All the Buddhists and many of the Brahmin castes abstain from the use of meat in any form. Ansell, an early writer, says: "It appears that tuberculosis is correspondingly non-existent in certain localities in India." Now, there is a constant change always taking place in such a country as India. Prejudices are dying out, and many of the people have undoubtedly adopted the habits of their conquerors. The English dairy cow is slowly but surely finding her way into India, or, as Mair, a deputy coroner of Madras, says: "Beef is not at all times procurable, but is generally sold about once a week in every station where there is a sufficient number of Europeans to render the slaughter of an animal worth the butcher's while, for little beef is used among the natives. Occasionally the slaughter of a fine English stall-'fed cow is advertised. In some districts the sale of beef is prohibited by law, out of respect for caste prejudices. Butter is an article difficult to procure of good quality, except on the hills, where it is sold by European settlers, who make dairy keeping contribute to their support. The native tendency is to palm off buffalo butter for that made of cow's milk." There is little doubt that when the English dairy system becomes well established in India, the statistics of phthisis will be uniform and

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undoubtful. Of course, the Buddhists and the Brahmins will be the last to adopt the dairy cow as a food producer.

Geographical and climatic conditions have little, then, to do with the prevalence of tuberculosis. There are undoubtedly conditions of climate, habitation, etc., that favor the development of the disease, if the contagium is present; and the contagion, I think, is always derived *primarily* from the dairy cow. The Kirghiz inhabiting the steppes of Russia, 100 feet below the sea-level, with a rigorous clime, intensely cold winters and warm summers, badly housed and fed during the long months of cold weather, no dairy cows, and an entire absence of phthisis. Take, as nearly as we can get, a diametrically opposite geographical and climatic condition, and we find Quito, the highest city in the world, situated 10,000 feet above the sea-level, located at the equator. "No torrid heat enervates the inhabitant of this favored spot, no icy breeze sends him shivering to the fire." "The mean annual temperature is 58°, the extremes 45° and 70° Fahr."* Now, we have quite positive and authoritative statements regarding this city. Professor James Orton, of Vassar College, who made a scientific ex-

* Orton, "Andes and Amazon," p. 92.

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pedition to the equatorial Andes in 1867, under the auspices of the Smithsonian Institution, says, at Quito, "suddenly we are looking down into the valley of Chimbo; there are herds of cattle and fields of grain, yet we shall not find a quart of milk or a loaf of bread for sale. Thousands of cattle are raised on the Paramos, but almost wholly for beef. A dislike to milk (observed by Humboldt), or at least an absence of its use before the arrival of Europeans, was, generally speaking, a feature common to all natives of the new continent. Some cheese, mostly unpressed curd, and a little butter, are made, but in the patriarchal style; only one American churn is in operation (in Quito, with a population of 80,000). The people insist on first boiling the milk, and then stirring it with a spoon; custom is omnipotent here, and its effect is hereditary." Professor Orton further says: "Consumption is unknown in the city." The testimony is unanimous that phthisis does not exist in Quito, but on the plains in Ecuador, according to Dr. Archibald Smith, who practiced there for 25 years, "the disease is not uncommon."

Professor Orton, after leaving Quito and traveling toward the Amazon, makes the following observation, which clearly indicates that the dairy cow exists in other parts of this country:

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"The following day we advanced five miles to Tablon, an Indian hamlet on the mountain-side. There we waited over night, and this was the only spot in South America where we found milk to our stomachs' content."

Without going into further details respecting separate communities, let us consider the statistics of Europe, and there we find that the prevalence of phthisis is regulated by the ratio of the bovine to the human race. Thus, in Ireland, where the cattle number 4,570,000, nearly an equal proportion to that of the inhabitants, according to Dr. Wylde, phthisis is by far the most fatal affection to which the inhabitants of that country are subject. Denmark, with about the same ratio of cattle to inhabitants, sustains about the same rate from consumption. In Portugal, where there are six inhabitants to one bovine animal, consumption attracts so little attention that few notices can be found relating to the disease in that country. In Italy, the distribution of cattle being one to six inhabitants, the mortality from phthisis varies greatly in different parts of the country, reaching the exceedingly low rate of 0.86 in a thousand in the Basilicata. In Egypt, where the ratio is one animal to nearly thirty inhabitants, Pruner tells us "that the disease becomes less in exact proportion as we proceed

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southward from the shore of the Mediterranean. In Central and Upper Egypt it is decidedly uncommon."*

Thus the statistics go on, and where the exceptions arise, the cause is always evident in the conditions that influence the breeds of cattle. Taking into consideration all the foregoing facts, there can be little doubt that the inbred species of the bovine race is the prime aetiological factor of phthisis in the human race. They not only nurse the germ and prevent its extinction, but sow it in the human race continually and abundantly; without their aid the germ would die, for of all the germs known none have so hard a struggle for existence in the human kind as the bacillus of tubercle, when we consider the comparatively few of the human race who are afflicted, and the immense number who are exposed to the infection and escape it.

Up to the present writing the cow is the only known animal that has transmitted tuberculosis to her offspring in inheritance, and even here we have only one case. I am fully aware that this statement will meet with considerable opposition, as many of our best workers are of opinion that bacillary phthisis is hereditary in the human race.

* Hirsch, p. 192.

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But I have concluded that this is merely a theory, because, after diligent search, I have failed to find a well-authenticated case on record of a human foetus at term showing evidence of tuberculosis. We have, however, on record in the "Fortschritte der Medizin," No. 7, vol. iii, 1885, a case given by Johne of congenital tuberculosis in a foetal calf of eight months, and in Crookshank's "Manual of Bacteriology" (plate 18) is a stained illustration of the bacilli from this undoubted case. Just in the line of this hereditary tendency let me narrate an experiment of my own. Last summer I took the entire lungs and all the largely involved lymphatic glands from a cow dead from acute miliary tuberculosis, and, confining five laying hens and a cock, fed them exclusively on this matter till it was all consumed. I found after eight days one of the hens, which I killed, had tubercular affection of the laryngeal glands; I took twenty-six of the last eggs laid by these hens and put them under two setting hens in another part of the farm. Twenty-three of these eggs developed foetal chicks, but not a single one lived to come out of the shell. Two or three days after the period of incubation had expired, the hens themselves broke the eggs, but every chick was dead. I took some of the eggs that I had not used for setting to the Carnegie laboratory,

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and Dr. Grauer searched diligently for the bacillus tuberculosis, but failed to find any. He found, however, the presence of the germ in the lymphatic glands of the hen I had killed; he now has some of the chicks, but I have received no report from him as to their condition. Of the four remaining hens and cock, some one stole the latter when he was apparently quite ill, three of the hens died extremely emaciated, notwithstanding that they had abundance of good food after they had finished the tuberculized matter, and the remaining hen was killed by the burning of the building in which she was confined. This experiment needs confirmation by further experimentation. I had no idea that the eggs would not mature, or I should have placed with them under the same hens, eggs from healthy birds; there was no appreciable cause in the surroundings or other conditions to prevent the hatching except the beforementioned tubercular condition of the layers. I shall repeat this experiment, using eggs from healthy birds with those from tuberculous layers.

Without knowing that the fact is so, I have been looking up statistics of zoological gardens, and find that tuberculous animals fail to breed while in confinement. Of course we have no means of knowing how they behave themselves in their wild state, but I feel pretty safe in as-

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serting that no one ever found a wild animal with tuberculosis. Darwin's statement while writing on inheritance—" that, unfortunately, it matters not, as far as inheritance is concerned, how injurious a quality or structure may be if compatible with life "—only applies to the human race and animals which the human race is instrumental in breeding. To such animals, bred by the human race, Darwin applies the term artificial. We all know that in cattle one that is injured or unable to follow the herd is killed by the herd, and bulls in their wild state only maintain their supremacy by their vigor. The moment the head of a herd suffers from age or disease he is put away by the next strongest, and thus the vigor of the herd is preserved by this law of the survival of the fittest.

Man can not generate new forms, but he can so control and interfere with nature's processes as to modify the original design. Inbred cattle are selected, sheltered, and pampered, as they would be unable to withstand the rigorous conditions of the wild state; they propagate earlier and are larger milkers and more efficient beef producers, and their meat is more delicate and tender than that of the wild animal. All this is achieved by man at the expense of his own health.

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ON THE COINCIDENT GEOGRAPHICAL DISTRIBUTION OF TUBERCULOSIS AND DAIRY CATTLE.*

If it can be shown by reputable authorities that the geographical distribution of inbred dairy cattle is coincident with the geographical distribution of human tuberculosis, there is a reasonable presumption that these phenomena stand to each other in the relation of cause and effect. I am well aware that the doctrine, started by Wells, that malarial diseases are antagonistic to pulmonary consumption, appeared so plausible on its first announcement that several other scientific men adopted the theory, and even at the recent congress for the study of tuberculosis, held in Paris, the doctrine was again advanced by De Brun, of Beyrout, and sustained by Picot, of Egypt, after it had been entirely abandoned by such men as Hirsch and others, who, like him, had made the whole inhabitable earth their field of observation. This theory, like many another weak theory, was based on

* Read before the Medical Society of the State of New York at its eighty-fourth annual meeting.

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observations confined to a limited area and a limited length of time. To avoid this error, it has been my endeavor to extend my observations to every known inhabited portion of the globe, and to all periods of time, recent or remote; for it is impossible to study a disease like tuberculosis without a proper understanding of all the changes that have taken or are taking place in each country, because tuberculosis is slower and more uncertain in its development than the other common contagious or infectious diseases. One of the greatest disturbing elements I have found in the study of the geographical distribution of tubercular consumption is in the medical reports of the British army and navy, because, in countries enjoying an immunity from this disease previous to the invasion of these forces, many of the invaders, after the invasion, suffer from an attack, and often die from pulmonary consumption which they had acquired before leaving their native land; and consequently the statistics show deaths from pulmonary phthisis in the country, and thus rob it of its reputation for immunity, notwithstanding the fact that the natives themselves retain their exemption. This fact may be alleged as a refutation of the popular theory of the day—that climatic conditions stand in a causative relation to

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tubercular consumption, for many advocates of this theory imagine (consistently, if the theory were correct) that where climatic conditions form an aetiological factor, all residents of a country enjoying immunity by reason of its climate would be exempt. This is not so. Only those who are not infected are exempt; consequently we must look for some source of infection. Undoubtedly climatic and hygienic conditions favor the development of the disease in a human subject exposed to infection, and, therefore, the first and greatest question for us to answer, if we can, is, Whence comes the contagion? Is it indigenous in any of our domestic animals? No one denies, when a human subject suffers from an attack of glanders, that the disease was acquired from a horse; neither do we question the derivation of an attack of hydrophobia in a human subject; and we know that many other diseases are directly derived from some of our domestic animals. Now, if we were to take a single country like our own, and find that just in proportion as dairy cattle abound in a given community so does tuberculosis prevail, this might be a mere coincidence; but if we take the entire world and find the same existing connection between the two, these accumulated coincidences amount to a presumption that the con-

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nection is that of cause and effect. It seems to me very easy to settle the question whether the dairy cow does derive the contagion from us, as some thoughtlessly allege, or no. The only possible way in which a cow could acquire the contagion would be from its attendant, and surely, even if that attendant were affected, the only thing the cow could derive the disease from would be his breath or his sputa, and this in the proportion of one man to fifteen or twenty animals; the attendants, too, may or may not be affected, while in every dairy the percentage of animals affected by tuberculosis is from five to twenty-five per cent. Now, the danger the other way is straight and plain, because the human subject absorbs the entire animal, drinking its secretion while this lasts, and finally eating the animal up. Further, we find communities without pulmonary tuberculosis who have not dairy cattle, and we find, also, communities that have been exempt previous to the introduction of dairy cattle.

Here let me say that I wish, above all things, to avoid any appearance of having enlisted in the army of "alarmists." If the presence of tuberculosis were simply a danger that could not be avoided, and were to be threatening the entire human race, as many would have us believe, it

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would be better to let the question alone entirely. There are many people, both professional and lay, who cannot take a calm view of a danger; they must either approach it blindfold or else must rush from it with screaming terror that alarms every one within their hearing. Thus, we see at the present day sanitarians and health authorities urging the isolation of the unfortunate consumptive, the destruction of his clothing and everything connected with him, seemingly assuming that the human race itself develops the venom that is destroying it, like the scorpion that stings itself to death. I do not attempt to deny that it is possible for one human subject to convey the infection to another, but I think this danger very remote in comparison with the prime danger of bovine infection. If we take countries like Algiers and Egypt—where the tubercular bovine is still absent, but the human consumptive present, and the native population still exempt—we surely see that the danger of contagion from human to human is not imminent; while, on the other hand, if we take countries like Madeira, Australia and the Sandwich Islands, we find very plainly that the introduction of inbred dairy cattle tuberculanzes the natives. I do not mean to imply that every one who drinks milk from tubercular cows will become tubercular, for, if this

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were a fact, instead of the deaths from pulmonary consumption forming one-seventh of the whole mortality, the great majority of civilized races would have become extinguished by the disease. I have known many cases of children and adults taking for years the milk of tubercular cows and yet exhibiting no symptoms of tubercular infection. We must always remember that some other systematic condition is necessary as well as the germ for the development of this disease; scrofulosis, temperature, certain hygienic or climatic conditions that tend to lower resistance, are all factors in the causation of a susceptibility to infection. This susceptibility, arising from any or all of the causes enumerated, may be present in some individuals in a community, and, unless the inbred dairy cow is a producer of food for that community, these cases, be they more or less numerous, will not suffer from tubercular consumption. There are localities with a rigorous climate, resulting from their altitude, where dairy cattle cannot be closely inbred, because inbred cattle could not stand the severity of the climate, and they are not, by reason of their breeding, tubercular. Such animals are not deemed by the modern breeder as the best dairy animals, for, requiring, by reason of their vigor and robust-

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ness, more of the food that they consume for their own nutrition, they have less of this food available for making milk. In the Highlands of Scotland and the Hebrides, where these creatures abound, the countries are not known as dairy countries, neither are they tubercular. It is significant that in the great dairy countries, such as England, Ireland and Denmark—in fact, wherever the dairy is one of the national industries—the prevalence of tubercular consumption is a settled fact, which requires no further consideration on our part. In those countries, however, where there is no settled dairy industry, and the habits of the people, are opposed to the care of dairy cattle, the prevalence of phthisis is rare or entirely absent. It is only in these countries that a doubt exists as to the extent to which phthisis occurs.

Now let us look at China. Here is a nation peculiar, to our notions. The reigning dynasty and high officials are of Tartar blood; the bulk of the people are pure Chinese. Andrew Wilson, who made a trip through China and Thibet, and published his book in 1875, says: "It is very extraordinary that .... the Chinese should so entirely eschew the use of milk in every shape; at Lassa the pure Chinese do not take any milk, and the reason they gave for not doing so was

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that milk made people stupid. The Chinese may have got this idea from the fact that the Tartars, who are necessarily milk drinkers and eaters of dried milk and buttermilk, are a very stupid people."* Pumpelly, who traveled extensively in China under the auspices of the government, says: "Great as is the variety of food in the Chinese cuisine, some things are missed by the traveler—such as bread, butter, and milk. A little milk is sold."† The same writer adds, respecting the city of Pekin: "During the winter months this city has no rival in the world in the abundance and variety of the game and domestic meats with which its market is stocked. It receives large quantities of good beef from Mongolia."‡ I have abundance of testimony to the same effect, as many travelers have written relating to this country. Of course, there is nothing in this that indicates how their cattle were bred, or how much milk they consumed, but this and all other testimony emphatically indicates that the pure Chinese, of which the poorer classes are entirely made up, do not drink milk, while the Tartars, the ruling and military class, do get milk and beef; and I can show from reputable medical

* The Abode of Snow, New York, 1875, p. 197.
† Across America and Asia, New York, 1870, p. 302.
‡ Across America and Asia, p. 274.

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authority in China that, of these two classes, the former are the non-tubercular when the disease shows itself in that country. Thus Dr. Wang, a Chinese physician educated in Edinburgh, where he had undoubtedly been taught that climatic, hygienic, and dietetic conditions were the causes of pulmonary consumption, writes concerning diseases of the chest in China as follows: "The rarity of consumption among the country people and the greater exemption from it of the laboring class in the city, notwithstanding that they are badly housed and badly fed, must be attributed to their exercise in the open air.... Still, I cannot quite understand why phthisis is not more prevalent than it is among them, especially the country poor, whose food often seems not more than half sufficient to support life." In regard to Canton, Dr. Wang says: "Phthisis is tolerably prevalent, but by no means so common as in Europe and America."* Of course, Canton cannot be looked at like the rest of China, for seaport towns are afflicted with imported cases, even when the disease is not indigenous. Dr. Jamison† says: "The testimony of all foreign practitioners in China who have written on the subject is unanimous as to the

* Dobell's Reports, vol. iii, 1877, pp. 33, 34.
† *Ibid.*, vol i, 1875, p 283.

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rarity of phthisis originating here among foreigners; every instance of chronic phthisis which has come under my care has been imported." Thus the statistics of this city cannot be included in the history of the disease in China. We see, then, that among the poorer class pulmonary consumption is absent or rare, while among the better class of Tartar Chinese, phthisis is not an uncommon disease. Thus Surgeon-General Gordon dwells on "the frequent occurrence of phthisis among the better classes at Tien-tsin, especially among women."* Here, of course, are the classes that get the milk and the meat. It is very interesting to read the reports of medical men regarding phthisis in China, and the different reasons by which they endeavor to explain its rarity. Mr. Porter Smith says: "Supposing phthisis to be rare, it cannot be attributed to the absence of a special tuberculiar diathesis among the Chinese;" and Dr. Reid, after enumerating the supposed causes of phthisis, says: "'If consumption did not follow as a consequence of all this, we should have a result different from what has been observed in other parts of the world where like predisposing causes are found, ... or that some other conditions exist that modify

* Dobell's Reports.

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or neutralize them." The before-quoted Dr. Jamison says that bronchial catarrh is exceedingly common and often simulates phthisis.

Here, then, we have a country with two classes —one milk-drinkers and the other non-milk-drinkers—and medical authorities have not been able to assign an acceptable reason for the prevalence of phthisis in one class and not in the other, where the commonly received predisposing causes exist to the greatest extent.

Let us now direct our attention to regions where cattle abound, but not as inbred dairy stock, and where, consequently, milk is not an article of diet. Such is South America. "In Colombia the practice of milking cows was laid aside owing to the great extent of the farms and other circumstances. In a few generations, M. Rollin says, the natural structure of parts, and withal the natural state of the functions, has been restored. The secretion of milk in the cows of this country is only an occasional phenomenon and contemporary with the actual presence of the calf. If the calf dies, the milk ceases to flow."* Holden,† in his interesting book on this country, says that butter is unknown, milk only occasionally used and only extracted from the cows when

* Prichard, Nat. Hist. of Man, London, 1843, p. 34.
† Holden, New Granada, New York.

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they have their calves with them, and always boiled. This author also adds, in his chapter on diseases in this country: "There is little or no consumption. I do not recollect of a single case." As to the Argentine Republic, Consul Baker, of the United States, writes in the *Western Dairy Journal*, "It may seem paradoxical, yet it is true, that, while the Argentine Republic contains 12,000,000 of horned cattle, it produces neither butter nor cheese; such a thing as a dairy farm is unknown; such a thing as butter-making, in the true sense of the word, is a myth; such a thing as a cheese factory, if we except a cheap curd produced in Goya, has never been attempted. In this immediate neighborhood you may or may not find milk enough for your coffee, but elsewhere no one, with rare exceptions, keeps a milch cow; butter, if used at all, has, until very recently, been brought from Italy; of late, unsalted butter, the work of Spanish Basques, near Buenos Ayres, has been finding its way to market..... Not long ago I visited a ranch stocked with 15,000 cattle, and we did not have a mouthful of butter for our bread, while our coffee was seasoned with condensed milk from Illinois." We find, from the writings of Mantegazza on the health of this country, quoted by Hirsch, that there has been, within the last fifty or sixty years, a diffusion of

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phthisis along the coast of this republic, principally among the negroes and mulattoes; but in the interior and mountainous parts there is an exemption. Of course, in the case of phthisis along the coast, unless the imported cases are separated from the indigenous cases, the value of this evidence has no weight in our argument. It might be noticed that the invasion of phthisis on the coast coincides very nearly with the independence of the country and the accompanying admission of foreigners, while in the interior, where the natives are more numerous, immunity from the disease prevails.

I have in a previous paper cited the facts relating to Ecuador, and the remarkable result that the natives, where they do not use milk, are exempt from pulmonary tuberculosis. I have also in a previous paper alluded to the absence of phthisis in Egypt, where the indigenous inhabitants did not make use of the milk of inbred dairy cattle. The conclusions I arrived at at that time were derived from my reading of the accounts of that country given by various travelers; and since then I have written to Dr. J. A. S. Grant, Bey, who has favored me with the following communication, dated September 3, 1889: "With respect to Egypt, we are almost exempt from tuberculosis unless among the black people

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and foreigners. The Copts and Arabs are remarkably free from phthisis pulmonalis. I think buffalo milk is the only staple of that kind supplied to the villages, but I know that in the large towns there are European cows." This shows plainly that the natives do not breed dairy cattle and are exempt from pulmonary tuberculosis, while in the towns it is probable that the European cows mentioned in the bey's letter supply the milk to the foreigners.

Like Egypt, all the rest of northern Africa seems to be exempt from tuberculosis. Thus regarding Morocco, a country to which I have not before alluded and which was thoroughly explored by Dr. Rohlfs in 1861, who adopted the habits and manners of the natives, acting as a physician both among the people and in the army, he writes in his book: "Diseases of the lungs are scarcely known in Morocco,"* and in enumerating the prevailing diseases he omits pulmonary consumption or phthisis entirely from the list; and he also says: "the animals of the Draa oasis are fine and similar to those in Morocco, such as the horse, ass, mule, and goat; cattle are not common. The sheep in the Ternate provinces are woolless."† He speaks only of sheep's milk as used for food in the country.

* Rohlfs, Adventures in Morocco, London, 1874, p. 83.
† *Ibid.*, p. 348.

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Taking a square of ten degrees of longitude and latitude, making the geographical portions nearly identical, we have in this square Morocco, Portugal, and Spain. Now, these latter countries were mostly in the possession of the Moors for centuries, and although they are classed among the civilized races, there are many remains of Moorish customs and culture still surviving. They are an agricultural people, and the dairy business is one of the agricultural pursuits.* According to Brandt, quoted by Hirsch, consumption is prevalent in this country. This condition of affairs applies also to Spain, as these two countries are usually classed together. Now, it must be granted that the geographical differences between these countries and Morocco are not sufficient to account for the prevalence of pulmonary consumption in the one and its absence in the other, the presence of dairy cattle in one and not in the other is probably the most marked and significant difference. This difference will be found everywhere in the world where cattle are bred for the sole purpose of producing milk or early matured beef.

I am very firm in my conviction that cattle can be bred in such a manner that they will be

* Oswald Crawford, Portugal, Old and New, New York, p. 155.

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neither scrofulous, nor tuberculous, and in these respects not dangerous to the human race. After due deliberation and serious study, both as a physician and as a cattle breeder, I am firmly of the opinion that the blessings conferred upon us by the bovine tribe far outweighs the burden of the disease which they have entailed on us. When I read of countries that have no tuberculous food-producers, and consequently enjoying a total immunity from this disease, I remember at the same time that they suffer from still more grievous afflictions, both from the lack of the food furnished us and from the presence of disease in some form derived from their own cattle. If it were impossible to improve our own domestic cattle in regard to their own and our health, I should, I repeat, be in favor of letting the matter rest as it is. Deeming it, however, quite possible to breed our animals without any scrofulous taint, and, in lieu of the burden of disease, assume the burden of a heavier financial expense, I earnestly urge a reform.

The foremost cattle breeders have aimed at producing an artificial animal, capable, when bred for beef, of early maturity and early fecundity; and, when bred for the dairy, all other considerations were made subsidiary to an abundant flow of milk. It would appear to these men ab-

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ject foolishness to breed an animal for strength, health, and robustness with a smaller yield of milk. They would not deem it an improvement to breed an animal that did not mature early, and whose dam would not produce a calf till she was three years old. But only by this method can we stamp out tuberculosis in our beef and dairy animals, and I am convinced that legislative action will be necessary to keep the breeders in this line, for it is one of the hardest things in the world to upset a recognized commercial system. Thus the question is focused: "Are we willing to pay more for beef and dairy products, and throw off the incumbrance of disease, or let the matter remain as it is—an abundant supply of cheap milk and cheap beef?"

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CONSANGUINEOUS BREEDING IN ITS RELATIONS TO SCROFULA AND TUBERCULOSIS.*

In the propagation of young, the union of two distinct sexes is an essential requirement for the higher order of animals, and Mr. Herbert Spencer accounts for the formation of two sexes by the assumption that thus only can consanguineous unions be avoided. If it had been better that animals should be produced from one individual and thus continuing to represent that individual and that individual alone, man and the higher orders of animals would have been created hermaphrodite or parthenogenetic. But in the great plan of nature we see, besides the different sexes, different groups of permanent varieties of the species, and breeds are the result of the mingling of these varieties in different proportions. Thus, in the human race, to avoid the repetition of a single individual, not only are there distinct

* Read before the Society of Medical Jurisprudence and State Medicine, March 10, 1890.

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sexes, but also distinct groups of the same species capable of mixing and reproducing their kind, and many of the races now existing are undoubtedly made up by mixture of two or more of the permanent varieties. The dominant race of to-day, the white race, shows distinctly that they are not derived exclusively from any one permanent variety, but must have been formed by the mingling of two or more of the permanent varieties, as evidenced by the existence in the same race of such different types as the blonde and the brunette, and of different temperaments, and the commingling of all these types in every conceivable gradation, as dark hair with light eyes, and light hair with dark eyes, red hair, and all kinds of varieties cropping out in the same family of children.

It seems to me that all those who have studied the subject of consanguinity have sight of this fact—that two individuals consanguineously related represent not only the immediate parents, but a certain mixture of the permanent varieties of their species. Thus some of the domestic animals that we know contain only two permanent varieties in the species, and it is from a mingling of these varieties that the breeds are made; and the permanency of these breeds depends on the amount of mixture of these varieties in each

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breed, as when one of these elements is bred out or attenuated, then the breed becomes scrofulous, sterile, and in every way deteriorated by the close consanguinity of one variety. And thus we find that animals more prone to scrofula, resulting from consanguinity, are those of the least number of distinct groups to the species; hence, in a few generations, if the mingling of the varieties has not been equal, one of them is bred out or attenuated to such an extent as to be almost entirely lost. Of course animals that produce many young at one gestation will show this deteriorating process sooner than a uniparous animal, because the debilitating effect of gestation must be greater. Thus the pig, a multiparous animal with two groups to the species, develops the scrofulous habit more readily than any of the other domestic animals. Next in order come the bovine tribe, a uniparious race, with two groups known at present, with a probability of other groups that have become extinct. These animals develop the scrofulous habit from in-and-in breeding, but not in so few generations as the pig does. According to this argument, the development of the scrofulous habit in man from close interbreeding would be remote, because there have been many permanent varieties of the human family; but there are in the human

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family many other deteriorating influences at work; alcoholism, syphilis, debauchery of all kinds have stamped their impress on the offspring, which is characterized sometimes only by the scrofulous habit and intensified by consanguinity.

Questions relating to consanguinity and scrofulosis have received an immense amount of attention and all kinds of conclusions have been reached; but, from the fact that scrofula is so slow sometimes in showing its results, except in the pig, in breeds that have resulted from the commingling of the groups of one species, even when the scrofulous habit has been thus developed, the positive diseases that follow this condition are not always developed, or developed at times only slowly, and so remote from the original primary causes that these causes are lost sight of. Tracing up the course of some of our specific contagious fevers, we are able to see the connection between the primary cause and the specific, and, these being so close together, we are always able to grasp the whole train of cause and effect. In scrofulosis, effects do not follow causes in the same number of cases where circumstances tend to develop the cause, as in the specific fevers, because scrofula is always a congenital condition and is not itself a disease, but

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a susceptibility to morbid conditions that are so uncertain and insidious that consequently the study of this condition is always misleading when small groups or limited areas constitute the field of observation. It is only in large masses of facts with numbers of living beings whose origin, pedigree, modes of breeding, and all other concomitant facts are taken together, that we can reach a clear solution of the connection between consanguineous unions and their train of diseases. Thus I have ascertained, taking the whole world as the field of observation, that human tuberculosis exists only in those communities closely associated with the inbred bovine species. This observation does not, of course, exclude the now acknowledged fact that bacillary phthisis can be conveyed from one human subject to another by contagion, because this is a part of the fact that the original contagion was derived from the bovine species; thus, where the inbred tubercular cattle are unknown, bacillary phthisis is also unknown.

I do not desire to discuss any of the questions relating to race problems, but, from several years of close study of the methods of cattle-breeding and their diseases, and of their intimate relationship to mankind, I am convinced that the bovine race is scrofulous, the result of close consanguin-

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ity, and tubercular from their scrofulous habit, and this fact is almost too well known to need the addition of any one's testimony, as a great majority of those who have studied the subject are agreed on this point. But I am thoroughly convinced, as I have said before, that the inbred bovines, by reason of their scrofulous habit and consequent susceptibility to tubercular disease, convey to the human race bacillary phthisis; that this danger can be avoided, and, to point out methods of protecting the human race from this source of infection, I would adduce the following argument:

As I stated in the beginning of this paper that the pig was more prone to evil results from consanguineous union than any of the other domestic animals, and that these evil results follow more closely the primary cause and, therefore, can be more easily traced, and the fundamental principles of the argument more simply and clearly demonstrated, I will commence with a few illustrations, gleaned from the best authorities on questions of breeding, respecting that animal.

This species can be divided into two groups, or permanent varieties—namely, the *Sus indicus* and the *Sus scrofa*—and all the different breeds are made up of these two different groups of the pig family. So distinct are these two varieties

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that Nathusius (quoted by Darwin) says that he can trace the infusion of one-thirty-second or one-sixty-fourth part of the blood of one of these groups into that of the other, in the bony formation. Darwin himself says: "With respect to pigs there is more unanimity among breeders on the evil effects of close interbreeding than perhaps with regard to any other large animal. Mr. Druce, a great and successful breeder of the improved Oxfordshires (a crossed race), writes: 'Without a change of boars of a different tribe, but of the same breed, constitution cannot be preserved.' Lord Western was the first importer of a Neapolitan boar and sow; 'from this pair he bred in and in until the breed was in danger of becoming extinct, a sure result (as Mr. Sidney remarks) of in-and-in breeding.'" Mr. Darwin further relates that a Mr. Wright, a well-known breeder, bred a family of pigs in-and-in for seven generations; the number of pigs was reduced at each gestation, and of the offspring thus produced many were idiotic, without sense even to suck, and, when attempting to move could not walk straight, till finally one sow was the sole offspring. She was the handsomest of the entire seven generations, but would not become pregnant by her sire, while to a stranger in blood she bred at the first trial. "Nathusius

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gives an analogous and even more striking case. He imported from England a pregnant sow of the large Yorkshire breed, and bred the product closely in-and-in for three generations; the result was unfavorable, as the young were weak in constitution, with impaired fertility. One of the latest sows, which he esteemed a good animal, produced, when paired with her own uncle (who was known to be productive with sows of other breeds), a litter of six, and a second time a litter of only five weak young pigs. Then he paired this sow with a boar of a small black breed, which he had likewise imported from England. This boar, when matched with sows of his own breed, produced from seven to nine young pigs; now, the sow of the large breed, which was so unproductive when paired with her own uncle, yielded to the small black boar in the first litter twenty-one, and in the second litter eighteen young pigs, so that in one year she produced thirty-nine fine young animals. Colonel Le Conteur writes me that from possessing a fine breed of pigs he bred them very closely, twice pairing brothers and sisters, but nearly all the young had fits and died suddenly."*

All the above is taken from Darwin, who, of

* Darwin, Animals and Plants under Domestication, Vol. i, p. 101.

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course, only quotes from the works of others; but the facts as stated are well known, and no successful breeder to-day practices close consanguineous unions in breeding his pigs. It would be very easy to compute the possibility of breeding out an infusion of one of the varieties where it existed only in the proportion of a third to the other varieties, with this close interbreeding, and it is also easy to understand how a cross with another breed or another family of the same breed would change the combination of the minglings of the two varieties.

That pigs are scrofulous from this close union is well known. The word scrofula is derived from the name of one of these groups, the *Sus scrofa*, and the name undoubtedly indicated the well-known fact that close consanguineous unions of these animals produced a constitutional condition resembling in all respects, at least as near as an animal can, human scrofulous diathesis; and, furthermore, the common people have noticed this resemblance and termed scrofulosis "swine evil." The reason why these animals show the evil results of in-and-in breeding more plainly and quickly than some other of the classes of domestic animals, arises from the fact that there are only two groups of the species, and hence there is less possibility of modification than

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in the species with a larger number of permanent varieties. Thus, I believe if a species of animal existed that was unique—that is, with no varieties—consanguineous breedings would be productive of more early evil effects than it is even in the pig, and probably some of the races that have become extinct were races that were so situated as to make it impossible to receive an infusion of blood from some of the other permanent varieties of these species.

Now, as a contrast, to the pig, let us take the horse and the sheep. Neither of these animals is scrofulous, and in-and-in breeding can be carried on with them without the same apparent tendency to deterioration; neither are these animals subject to tubercular infection, with very rare exceptions. The breeds of domestic sheep are made up from eight or more permanent varieties; it is therefore easy to see how many admixtures of different bloods can be infused together to make the different breeds. Therefore the possibility of working out all the combinations by consanguineous unions would take a great length of time; and the same rule applies to the horse in his insusceptibility to scrofula and tuberculosis; but there are many other conditions associated with the horse under domestication that, of course, belong to the domain of heredity,

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such as spavin, ring-bone, exhaustion from overwork and severe strain, stomach derangements, etc., and these make the in-and-in breeding of horses sometimes unprofitable. Still consanguineous unions in the case of this animal are never productive of scrofula and its attendant train of disease.

All the foregoing facts, deductions and suggestions will help us in our study of the main question. That question is, can we prevent the development of scrofula and tuberculosis in the dairy cow and thus eliminate this disease from the human family? There is no other animal in creation that is so closely and intimately associated with some communities of the human race as the domestic cow. Her milk is one of the most absolute necessities for the nursery and the table in every household; every part of her flesh and the large viscereal organs are consumed as human food; her blood is consumed by some communities. All civilized races of the present day acknowledge the utility of vaccine virus for the prevention of small-pox, and this virus is transmitted through the system of her calf before it can serve as a protective virus for the human system. Her hoofs and horns are transformed into the gelatin which constitutes one of the delicacies of the table and sick-room, her hair enters

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into the composition of the plasters on our walls, and with her hide we cover our feet. This animal has been bred to a two-fold purpose—namely, to furnish us with milk and with beef; in breeding the dairy cow every other point has been lost sight of except the main function of a milk-producer. The well-known scrofulous forms in animals and the human kind are, unfortunately, the largest milk-yielders. Therefore, in some of the noted milking breeds the form sought after by breeders is that which will correspond with the delineation of the characteristic form of scrofulosis given by Miller,* as follows: "The complexion is fair, and frequently beautiful, as well as the features; the form, though delicate, is often graceful; the skin is thin and of fine texture * * * the pupils are unusually spacious; the eyeballs are not only large but prominent; the eyelashes are long and graceful." Now let us contrast this description of human scrofula with Dr. L. H. Twaddell's description of a noted dairy cow. "The Jersey cow is of medium size; her peculiar deer-like aspect distinguishes her * * * her head is long and slender, the muzzle fine, the nose is black, and the large, dreamy eyes encircled with a black band * * * the limbs of the Jersey are very slender and fine; her

* Principles of Surgery, p. 53.

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neck is slender and rather long;" and Colonel George E. Waring, Jr., says he knows of no fault in the milking cow greater than a thick skin. Thus we have in the scrofulous human subject a beautiful form, a thin skin, large eyes, and the same characteristics as those found in the best milking form of the dairy cow. Scrofulous females in the human race usually secrete an abundance of milk, although they are not deemed the best nurses. Even Donne alludes to this fact and cites in his work on mothers and infants the case of a nurse that suckled the children of one of the most noted Paris physicians, and was recommended by him to other noted families, who, when examined by Donne himself, was found to be in a scrofulous condition. Of course, she must have given an abundance of milk to be thus recommended. I know, too, from my own experience, that scrofulous females, as a rule, secrete a larger quantity of milk than healthier ones. Although the scrofulous female with her abundance of milk would not be recommended as a wet-nurse, the beautiful scrofulous dairy cow is never declared contraband.

Let us now examine the pedigree and breeding of the dairy cow and see why this animal is scrofulous. The domestic breeds of the bovine tribe are made up from two permanent varieties

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of the species—namely, the *Bos longifrons* and *Bos primigenius;* these two varieties are distinctly identified, one as the large, the other as the smaller form, and the most noted dairy breeds belong to the smaller with very little of the larger breed intermingled, while the beef breeds belong to the larger form with more or less infusion of the smaller to make the distinctive breeds. Let us take one of the most noted dairy breeds we have—the Jerseys. These animals have been bred on the Channel Islands for several generations, without ever having received a cross from other breeds, and they were the only breed on the island of Jersey. These animals have now been distributed by exportation among breeders in various parts of the world, but the noted herds are still inbred in the closest possible manner.

I have several tabulated pedigrees of American-bred Jerseys, and will cite that of "Iduna." Through six generations the male parent, "St. Helier," himself an intensely inbred bull, has been the sire twenty-five times in her genealogy —that is, impregnating his own female progeny through twenty-five lines in descent. Animals produced by this method are truly delicate and beautiful, and usually good milkers, and in other points fulfill Miller's description of the human

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scrofulous female. Now, scrofula is not always tuberculosis, but I believe that scrofula precedes tubercular infection. In this connection the following quotation from Hazard's book on the Jersey, Alderney, and Guernsey cow may be of interest: "Accordingly some *good milkers*, and particularly old cows in which vital activity is constantly decreasing and systematic reaction becoming progressively more and more difficult acquire a sickly appearance; the defective lymph is deposited in the form of tubercular matter so constantly found in the chest of old cows, the animals become phthisical, the organs of procreation become unhealthy; with more or less constant irritation of the ovaries, the cow becomes barren. With this irritation there is a periodic check to the secretion of milk; nevertheless, a very considerable flow still continues."

There is little need for me to add that this milk sometimes finds its way to the nursery of a scrofulous infant. Now, no one denies that these intensely inbred Jerseys are notoriously tubercular; they are nearly all scrofulous, and it is notorious that this breed is subjected to the most intense consanguinity; and Walley, the well-known writer on bovine diseases, says in his book, The Four Bovine Scourges: "The breeds of animals that in my experience are most subject to tuber-

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cle are Alderneys, Guernseys (the latter in much less degree than the former), and short-horns among home cattle, and among foreign cattle the Danish." Now, we know all these breeds enumerated by Walley belong to the most closely inbred dairy and beef stock; among beef cattle the short-horns are the most intensely inbred. As a rule, these beef cattle do not show the same distinctive processes of the tubercular infection because they are not submitted to the drain of continual lactation as are the dairy breeds, and, moreover, are well fed and cared for, and butchered when they are between three and four years of age; hence they only show their true condition when opened by the butcher. Furthermore, to show that this scrofulous and tubercular condition is the direct result of consanguineous breeding, we will take a breed of cattle that enjoys an immunity from tuberculosis. Walley, the author above quoted, says: "The polled Aberdeenshires seem to be particularly exempt." Mr. Clement Stephens, chief veterinary inspector for Northumberland, states: "There is another and more valuable advantage these cattle possess—namely, their remarkable freedom from tubercular diseases. Of course I cannot assert that it has never been in this breed of cattle (the Aberdeen), but this I can say: That, although I have had

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special opportunities for research, and have examined great numbers of cattle, both alive and post mortem, I have never yet seen a trace of it in this breed." Now, these cattle are not of an inbred breed. The rigorous climate of their native land and the lack of housing they receive make it impossible for the thin-skinned inbred animal to exist under these circumstances. The following is quoted from the *Breeder's Gazette* with reference to these animals: "The necessity of keeping a house over his head has prevented the Aberdeenshire breeder from following the caprice of fashion; the blue-blooded breed for which there used to be a kindness in some directions is dreaded beyond everything; the very blueness of his blood makes him dangerous." From the same source I quote the following from a correspondent who had seen these cattle and examined their thick coating of hair and protecting skin; and comparing them with the short-horns, he says: "But I now firmly believe that every one of those animals that have that peculiar soft handle (feeling of the skin) that I was taught by my brother in the short-horn world to so much admire, is tuberculosis in one or other of its stages. Up to the time that an animal is in the last stages of this fell disease I feel its handling would delight many of the best short-horn

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judges. We have bred too many of the short-horns to death." The great breeder of the polled Angus and the great authority on the breed, Mr. William McCombie, writes thus in his work on Cattle and Cattle-breeding: "To continue for any length of time to breed in-and-in is not only against my experience, but I believe against nature." I have also searched through the records of this breed and works relating to it, and I find none of them giving evidence of close inbreeding. We have thus the two-ends of the cattle-breeding question—one, a small, intensely inbred and pampered breed, the predominating dairy cow, a true scrofulous animal and numerously affected by tubercle; the other, a large, hardy cross-bred animal, with all evidence pointing to a total immunity from tuberculosis.

Now, I have seen it stated many times that cattle that are tuberculous become infected from their attendants spitting and coughing around the stable. If this were at all an aetiological factor, we should find no breed of domestic cattle exempt, because they are exposed to the same or nearly the same class of associates with about the same degree of intimacy, and it would be very strange if one man to ten or twenty cows, even if he were phthisical, should be able to infect 10 or

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15 per cent. of them by his coughing and spitting, and they not affect him while he is drinking their milk, eating their flesh, and inhaling their breath. This is really not a part of the subject under discussion; I simply introduce it here while discussing these two breeds—the tubercular and non-tubercular.

I think there can be no doubt whatever that the in-and-in breeding of animals, with two or three permanent varieties only to the species, does produce a constitutional weakness, to say the least, that is not capable of resisting bacillary tubercular infection. Tuberculosis itself is rarely an inherited disease in the bovine tribe, where this disease is indigenous. I have myself examined many foetal calves, whose mothers were dead from acute miliary tuberculosis, without ever finding the gross evidences of tubercular infection; so I think it safe to say that the rule is that the disease is not transmitted by inheritance, and consequently the best way to eliminate a disease of this kind, which we know must be preceded by a hereditary constitutional dyscrasia, is to breed animals, as we surely can do with our domestic cow, so that they will not inherit this scrofulous habit.

Of course, as I have said before, these two

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questions of consanguinity and scrofulosis are difficult to study, and cannot receive their true interpretation from any few isolated cases or small groups of facts, and the only positive determination that we can arrive at is derived from the study of all the dairy breeds. In them we see that those which are habitually inbred are scrofulous, as a rule. I am aware that almost any one can adduce simple isolated cases showing that an inbred animal is not scrofulous or tubercular; but when the facts stands this way, that when all the scrofulous and tubercular animals occur among the inbred varieties, and not at all among those that are not inbred, the deduction to be drawn is obvious; and it is just this combination of facts that makes the study of consanguinity. scrofulosis, and tuberculosis so elusive. All the inbred animals are not scrofulosed, and all those that are scrofulosed are not tubercular; and thus, when we take the *one* breed that is notoriously tubercular, we find the facts *pro* and *con*, as to the transmission of scrofulosis and the invasion of tuberculosis are of equal weight, or, if anything, the preponderance of evidence would be against the deteriorating influence of consanguinity; but when we have the breed that is exempt from these conditions, and observe that the only

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difference is that it is not inbred, then we account for the presence of less or more tuberculosis by the disturbing influence of consanguinity. And so with the study of tuberculosis beyond these questions of breeding. We find, to all intents and purposes, people surrounded by the same influences and exposed to the same degree of contagion and infection and only a small percentage acquire the disease. We have no doubt about many other of the contagious and infectious diseases, because effect and cause can be grasped at one time, and a majority of persons subjected to the same exposure in the same circumstances become infected. And, so, then, we have to study this disease—tuberculosis— in the same manner in which we have to study consanguinity—that is, by taking whole communities or nations, as it were, and if we find in one country immunity from tuberculosis in the human race and no tubercular cattle associated with it, and in another community, notoriously tubercular, drinking milk and eating meat from domestic inbred animals, then we have the large aggregation of fact that points to but one solution.

Now, there can be no doubt in the minds of intelligent men as to the methods necessary to render the dairy and beef products safer for hu-

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man food. The only conflicting element to what is an obvious and necessary reform would be that inexorable law of compensation. The present methods of breeding our best milk and beef producers have undoubtedly lowered the price of both these commodities, and with this lowering of price we have entailed on us the tax of disease. If, then, we wish to avoid this burden and breed our milk and beef animals with health as the ultimate aim, milk, at least, will be a far dearer commodity than it is at the present time, and so the question will be narrowed down to the simple one whether we shall pay eight or twenty cents a quart for milk. I am only aware that it is a very difficult matter to make a reform in the methods of cattle breeding that have been carried on for so many generations, and done very often by men who imagined that they were conferring great benefits on the human race. It will only be by constant agitation, and by a constant arraying of facts, as I have suggested, from large areas and long periods, without ever allowing this important question to be narrowed down to individual or isolated cases, as such comparisons of a limited number of facts have always led to hasty, confused, and unsatisfactory conclusions when applied to such questions as those of consanguinity, scrofulosis, and tuberculosis.

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If a sweeping reform is ever made, as I am convinced it should be, it will only be effected through legislative action, for I am convinced from my experience that our lives are not long enough to turn some of the cattle breeders from the error of improving, as they deem it, our dairy cows and some of the beef breeds of cattle.

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[Reprinted from "The New York Medical Journal," December 20, 1890.]

THE MIMICRY OF ANIMAL TUBERCULOSIS IN VEGETABLE FORMS.*

At one time I become deeply interested in reading the travels of Livingstone and other brave and noted explorers of Africa, and, while my mind was full of the wonders and mysteries of the Dark Continent, I met a gentleman who informed me that he had resided many years in Africa. I tried to obtain from him information which I had been in search of. I spoke of the geographical problems to be solved and the difficulties to be surmounted in civilizing that enormous continent, and the whole burden of his comments was that Africa was a great country and would be easily civilized and all obstacles overcome if it was only properly drained. Now, this man's residence in Africa had been confined to the west coast, where the notorious swampy and malarious districts lie, and, because he had not traveled farther or interested himself in the travels of others, he imagined that all Africa was

* Read before the New York State Medical Association at its Seventh Annual Meeting.

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like that portion of the country which he did know would be the better for draining.

We should all naturally be surprised at the narrowness of this man's views, who imagined that an immense continent with snow-capped mountains and rainless deserts of vast extent could be judged from the narrow limits of a malarious swamp, where he had resided for a few years; but, on reflection, the idea could not but occur to me that we medical men, in our studies of the Dark Continent of disease, were often as narrow in our views as this man was in his views of Africa. For instance, a very few years ago Koch discovered in a tubercle numerous bacilli, and straightway we fancy that the tubercle would be harmless if it were only drained of its bacillus, and we put ourselves to work with hot air, rectal injections, medicated inhalations, etc., imagining all the time that we could subdue this terrible and mysterious disease and settle all the difficult questions of pathology connected therewith by simply eliminating from the economy the bacillus of Koch. The bacterial region is emphatically now our place of residence; we wade through the swamps of pus, blood, and morbid tissues, pushing aside all other forms and vital processes, after the beckoning specter of a bacillus, and, when we find it, flatter ourselves that we have reached the

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goal and discovered all that is necessary to conquer a disease associated with this small organism. We hardly inquire how it gained its position, what its functions are other than what we imagine as being concerned in the causation of disease, but accept it as the spirit and soul and prime factor in the cause of pulmonary tuberculosis. Happily, the tendency now is to break beyond the bounds of this narrow bigotry; hence I think that a study of some of the vegetable forms that closely mimic animal tuberculosis will help us in our march beyond the narrow swamp through which we are still struggling.

One of the vegetable diseases which mimic very closely tuberculous animal processes is seen in the nut-gall. The nut-galls are truly tubercular processes affecting the breathing apparatus (leaves) and the nutritive channels (roots) of plants. These galls are among the most puzzling of natural phenomena. It is actually known that the *Cynips*, or gall-fly, a small insect of the hymenopterous order, punctures the leaf of a plant or tree, and there deposits an egg, injecting at the same time a very minute drop—the animal itself is only one-tenth of an inch in length—of what is described by entomologists as a poison, but which is, beyond doubt, a digestive ferment. This fluid, injected by the insect into the cavity

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that holds the egg, affects the nutritive process of the plant in such a preponderating manner that it allows the egg to rest in the cavity without the irritating results of the intrusion of a foreign body, and the extraordinary nutrition caused by the ferment goes on to form the tubercular mass known as a gall.

Far more interesting and more closely analogous to animal tuberculosis is the disease attacking the grape-vine caused by the insect called *Phylloxera.* Can anything in plant-life more closely resemble a human tubercular lung than a leaf of a grape-vine with the galls of *Phylloxera?* "In August, 1835, Luiz de Andrade Corvo presented a paper to the Academy of Sciences in which he asserted that the vine disease ascribed to *Phylloxera vastatrix* was really due to a bacillus, or rather, according to his description, to a bacterium, which is always found in the tubercles of the radicles and in the tissues of the vine which are affected by this disease, termed by him *tuberculosis.* They are also found in the body of the insect, which thus becomes simply the agent of contagion." *

Now, has not this author narrowed his views down to the bigotry of bacilli-worship? The

* Microbes, Ferments, and Molds. By E L. Trouessart. D. Appleton & Co., New York, 1886.

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presence of a bacterium in this disease of plant-life is only one of many phases of a morbid process. The bacillus he discovers here is merely the nutritive ferment deposited by all gall insects, and often, as we have already said, called a poison. The *Phylloxera vastatrix*, like the *Cynips quercus*, wounds the leaf, deposits its egg in the wound, and besides, injects the bacterium which is the nutritive ferment that produces the gall which characterizes the disease. The following sketch of the natural history of the *Phylloxera* is taken from John Henry Comstock's *Introduction to Entomology:* "The grape *Phylloxera* hibernates in the roots of the grape mostly as a young larva of the first or sedentary, agamic, wingless form. With the renewal of vine growth in the spring this larva moults rapidly increases in size, and soon commences laying eggs. These in due time give birth to young, which soon become agamic, egg-laying mothers like the first, and, like them, always remain wingless. Five or six generations of these parthenogenetic, egg-bearing, wingless mothers follow each other, when (about the middle of June in the latitude of St. Louis) some of the individuals begin to acquire wings. Thus is produced the second or migrating agamic, winged form. These issue from the ground while yet in the pupa state; as soon as

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they have acquired wings they rise in the air and spread to new vineyards, where they lay their eggs usually in the down of the under sides of the leaves. Each individual of this generation lays from three to five, and some as many as eight eggs. These eggs are of two sizes; the smaller, which produce males, are about three-fourths of the size of the larger, which produce females. From these eggs are hatched in the course of a fortnight the third or wingless sexual form. It is a very remarkable fact that this form emerges from the egg not as larva, but as fully developed individuals. These sexual individuals are born for no other purpose than the production of their kind, and are without means of flight or taking food. After pairing, the body of the female enlarges somewhat, and she is soon delivered of a solitary egg. The impregnated egg gives birth to a young louse, which develops into the first form, and thus recommences the cycle of changes. It has been discovered that sometimes the first form during the latter part of the season lays a few eggs, which are of two sizes like those of the second form, and also produces males and females, which are precisely like those born of the winged form, and, like them, produce the solitary impregnated egg. Thus the fact is established that even the winged form is not essen-

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tial to the perpetuation of the species. Occasionally individuals abandon their normal underground habit and form galls upon the leaves of certain varieties of grape-vine. Owing to the great injury this species has done to the vineyards of France, hundreds of memoirs have been published regarding it. But as yet no satisfactory means of destroying it has been discovered. The difficulty lies in the fact that the insecticide must be one that can penetrate the ground to the depth of three or four feet, reaching all the fibrous roots infested by the insect. It must be a substance that can be cheaply applied on a large scale and that will kill the insect without injury to the vine. Where the vineyards are so situated that they can be submerged with water for a period of at least forty days during winter, the insect can be drowned. It is found that vines growing in very sandy soils resist the attacks of the grape *Phylloxera*. This is supposed to be due to the difficulty experienced by the insect in finding passages through such soil."

Here we have the whole natural history of a bacillary tubercular disease in plants. Notwithstanding the fact that every phase of its life history is well understood and the diseased parts can be seen and handled, yet its treatment is futile. This teaches us the narrowness of our study of

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human tuberculosis when we imagine that Koch's discovery of the bacillus placed us in a position to treat this complicated disease. We do not know the manner in which the bacillus gains the position it occupies in the tubercular mass, or why it sometimes attacks the lungs, and sometimes the glands, and sometimes the bones. Is it conveyed to its position by a host? Nothing we as yet know indicates this supposition except the analogy of vegetable parasites. It is not found in the blood or in the muscular juices. The present exclusive devotion to the observation of bacteria would almost preclude the detection of host if one did exist. Crookshank, in an appendix to his work on *Bacteriology*, says: "When examining blood, the bacteriologist must be prepared to meet the minute organisms, which at the first glance under moderate amplification may be mistaken for vibrionic or spiral forms of bacteria. The organisms referred to belong not to the vegetable but to the animal kingdom. They may occur associated with disease; but they appear to be more commonly found in the blood of apparently perfectly healthy animals." Thus the fact is stated by good authority that parasitic animals do exist in the blood.

This is not the only parasite to illustrate the mimicry of animal and vegetable morbid forms.

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There are myriads of parasites, and parasites on parasites, in the descending scale to the minutest forms. Thus all vital activity is kept in unison; nothing is allowed to die; one living organism ceases that others may continue, and the others in turn are dissolved to continue other phases of vital activity. The little germ that robs man of his vitality undoubtedly conveys that vitality to some other living organism, thus forming a link in the endless chain of organisms in action.

Another form of change not parasitic is suggestively analogous to the bacillary tubercular phenomena. The yeast plant is a germ, and undoubtedly Pasteur's noted researches on the life history of this plant formed the starting point for the universal study of bacteriology to-day. No thinking man could have followed his reasonings, conclusions, and deductions without concluding that all febrile conditions at least were the result of the growth of germ-life, producing ptomaines, extractives, etc. There are many phases of alcoholic fermentation that mimic the morbid processes of bacillary phthisis.

Thus we know that the presence of the tubercular germ in the mouth or other parts of the body is not always followed by tuberculosis. Analogously we know that the presence of yeast germs in a saccharine solution does not always

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give rise to alcoholic fermentation. The solution must contain less than 20 per cent. of the saccharine material. Thus the specific gravity of the solution is the controlling condition in the activity of the yeast plant. The same may be true of the human body. It can easily be understood that in the human body the specific gravity may vary. Thus an exceedingly fat and juicy body would be of lighter specific gravity than a closely-knit, hard, muscular body, and undoubtedly the specific gravity of the body has something to do with the morbid action of many of the germ phases of disease. Nor is this all. Before Pasteur's enlightening investigations it was supposed that the yeast germ was contained in the atmospheric dust, but Pasteur proved conclusively that this was not the case. He admitted atmospheric air and its dust into sterilized tubes of proper saccharine solutions for the growth of the yeast, but the alcoholic fermentation was never set up in solutions thus treated. Then the question arose, Where did the yeast plant come from? and further study revealed the fact that all kinds of fruit contained on their surface a germ termed by Engel "apiculated ferment" (carpozyma.) This is a hibernating germ, and, unless the fruit is bruised and its containing sugar in due proportion brought into contact, the

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germ will not grow or produce its special changes. This plant does not in any way resemble the ordinary yeast plant unless it is modified by its growth in a fermenting fluid. May we not then easily suppose that some germ-forms exist normally in the animal tissues prone to tubercular diseases, and only develop into the forms in which we find them when some anterior morbid process has been developed? This idea is concisely expressed in a paper read before the New York Medical Association, March 17, 1890, by Dr. James R. Leaming, a gentleman who has grown old in the study of this disease. He says: "I have seen no case of phthisis that could not be accounted for satisfactorily without supposing infection or contagion. I can say more. I have seen no case of phthisis where there was a probability of primary infection with no other cause.

"The first physical evidence of dead atoms in the system is their extension from the capillaries into the pleural cavities, as damaged leucocytes or ptomaines by physical diagnosis and this may be done before the presence of the bacilli can be detected in the sputa. The bacillus is consequent, not causative; it is true that ptomaines are in the blood before the expression of the leucocytes, but as a rule, not in abundance sufficient to attract the germs."

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This explanation of one phase in the development of tubercular disease will coincide exactly with the development of alcoholic fermentation in the case of grapes. Thus on the surface or in connection with the grape is a hibernating germ, and this germ is never brought into activity unless the grape is bruised and forms a solution, when the germ becomes active and changes the sugar into alcohol and other products of fermentation, which mimic the formation of ptomaines in the animal economy.

There are many other forms of vital processes outside of the animal body that mimic its morbid processes. All these forms are complicated, many of them mysterious, and associated with an interminable train of anterior and subsequent evolutions to the germ activity. My object in alluding to those enumerated is only to show the apparent fallacy of our imagining that because we have discovered the presence of a minute germ, we are also in possession of sufficient knowledge of the morbid processes associated with this germ to indicate a rational mode of treating the disease where the germ exists, without knowing definitely how much other conditions outside the germ have to do with the process. It has ever been one of the characteristics of scientific men to make sweeping and hasty de-

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ductions from the discovery of some one undoubted fact. I do not in any manner wish to detract from the honor and brilliancy of Koch's discovery, but I wish to protest against the tendency of the medical mind to-day to hang everything on the bacillus. For instance, if the bacillus was the only cause of tuberculosis, it would have to be viewed in the light of a foreign body within the tissues, and we know that foreign bodies always set up inflammatory action and subsequent suppuration, which is not always the history of tubercular processes. These are sometimes organized or cretefied. There is a germ disease where the morbid processes depend on the germ and the germ alone, and an abscess is always formed by this germ (actinomycosis) and a cleaning out of the abscess and total elimination of the germ cures the morbid process. But I think the presence of the tubercular bacilli must be viewed in somewhat the same light as the nut-gall of *Phylloxera*. In this the presence of the eggs is not the cause of the tubercular growth, because if the egg alone were deposited in the leaf it would act as a foreign body; it is the material that is injected into the leaf at the same time as the egg is deposited which sets up such an action in the nutritive processes of the leaf that the irritation of the egg is entirely overcome.

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Without much stretch of the imagination we can imagine the giant cell as occupying the position in the tubercle of human phthisis that the egg of the *Cynips* occupies in the nut-gall. According to this view, the bacillus would be the nutritive material causing the growth of the tubercle. These surmises and similes could be carried on *ad infinitum*, but I think the mimicry is suggestive enough to indicate to us that there is vastly more to be known of human tuberculosis than merely that a germ is present in a mass of morbid material.

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ONE OF THE APPARENT REASONS WHY MAN IS AFFLICTED WITH TUBERCULOSIS.*

The human race is grievously afflicted with tuberculosis, and it seems to be an old, old enemy to man. There is no organ or structure in his entire anatomy that is not subject to the invasion of the minute forms which make in man's economy, somewhere or anywhere, a tubercle for their residence. There is no other disease that is so capricious, so versatile, and so deceptive. It is unlike other diseases, because there is no constant road in which it travels; it attacks all ages and conditions under any and all apparent circumstances. Often and again man will imagine he has been able to make out the source of this stream of death, and finds, after years of study and research, other numerous sources that are just as much entitled to the distinction as the first discovery. For many years it was established with apparent truthfulness that the disease was a hereditary affection, but, when the dead-house was entered and the foetus in the womb of

* Read before the American Social Science Association, August 31, 1892.

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the victim was investigated, it was found that with very rare exceptions, indeed, did the minute organism which characterizes the disease ever pass the gates of the placental circulation, and so, to-day, it is not classed as a hereditary affection, but as an acquired disease. We are quite confident at the present time that true tuberculosis is the result of the presence and growth of a small organism that invades the tissues and makes for itself a local habitation, which we term a tubercle from its resemblance to a tuberculous plant. At first it is insinuating and almost if not quite imperceptible, and, like Uriah Heep, very humble, but, as the colony increases and its abode enlarges, it begins to assert its presence, sometimes by simply stimulating the activity of the structure it invades, and later the entire economy takes on an increased activity, bodily temperature is increased, the blood circulation is accelerated, nutritive processes are impaired, waste exceeds repair, and the tuberculous abode of his majesty, the bacillus, breaks down into ruins, and the crumbling walls enter the river of life, which thus becomes putrid, and sepsis overpowers the victim. As to the little germ that causes the calamity, we know not whence it came nor whither it goeth after its dire work is accomplished.

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Man is not the only animal afflicted with tuberculosis. Undoubtedly, more deaths occur among the members of the human race than among the lower animals, but there are far more dairy cows infected with tuberculosis, in proportion to their number, than in the human family. There is one very good reason why fewer deaths occur among dairy animals than among mankind, and it was this discovery, which I am about to relate, which led me to the conclusion that the cow was the mischief-maker.

The reason that the tuberculous cow is not often killed by the tuberculous process is found in her high natural bodily temperature. We know pretty conclusively that the tubercle bacillus requires for its growth and multiplication a temperature above the normal human bodily heat, and, curiously enough, the raised temperature of the human subject that is pathognomonic of the growth of tuberculous masses is the normal bovine temperature. Consequently, tubercle will grow in the cow without any disturbance of her normal temperature, and the train of evil consequences that follows the effects of increased bodily heat does not occur in the cow from an invasion of tuberculosis. Therefore, the process goes on in the animal, and, unless other morbid conditions supervene to increase the bovine tem-

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perature, the tubercle does not break down and cause sepsis, which is always the cause of death where the primary disease is tuberculosis. When the cow dies of acute miliary tuberculosis some other than the existing tuberculous disease has supervened to increase her temperature and interfere with the normal condition of the tubercle. And right here is another curious fact—namely, that as some other condition than tuberculosis must arise in the cow to cause the breaking down of the tubercle when it exists, so, contrariwise, some other morbid affection than tuberculosis must first increase the temperature in the human subject before the tubercle bacillus can commence his morbid antics. When the tubercle-building has commenced by reason of a proper high temperature, the growth of the tubercle and the fermentative action of the multiplication of the bacillus will of itself continue the required heat, and this continued increased temperature is sufficient to lower nutrition and resistance, and consequently the tubercle finally breaks down, in man without the intervention of any other morbid condition, as is required in the cow, to cause the same septic condition that kills both.

Now let me enumerate some of the causes alleged as accounting for the presence of tuberculosis in man, and you will see that all of these

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causes are at work with our dairy animals under the present modes of breeding and feeding in the so-called best milk breeds.

First we will consider breeding. Vigor and robustness in the offspring are undoubtedly maintained by the union of individuals not consanguineously related. Consanguinity will always attenuate the vigor of any breed of animals. Close in-and-in breeding decreases the size, increases nervous intensity, promotes early maturity, and lowers the resistance to disease by reason of the delicacy of the muscular tissue. In other words, to use an old-fashioned term, consanguinity produces scrofula. Scrofula is a condition which we all recognize as one which seems to make the individual prone to phthisis.

Scrofulous females in the human race usually secrete an abundance of milk, because in scrofula there is an unusual tendency of glandular enlargement and activity. As the mammary is the highest type of glandular structure, it is stimulated to increased action. A scrofulous cow is usually the largest milker, and the closest kind of consanguinity has been practiced by cattle-breeders, with the object of producing a scrofulous animal, not because she is scrofulous, but because the particular form she represents are the largest yielders of milk. We find, too,

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that consanguineous breeding has been alleged as one of the causes of tuberculosis in the human race, where it never can be conducted with so close and intimate blood relatives as in the dairy animals. So here we have at work in the cow one of the alleged causes of tuberculosis in man.

Next in regard to climate. The absence of phthisis in high, dry, mountainous regions has been accounted for by reason of the altitude and absence of moisture in the atmosphere; but here occurs a somewhat curious fact—namely, that the cow dairy does not thrive in high, dry, mountainous districts, but in the low, swampy, moist region, where the succulent and lush grasses grow, is the place where the cow flourishes, and it is in these regions also that tuberculosis abounds in both the bovine and human subjects.

No name has shed more light on the history of phthisis than that of Laennec, who himself died of a pulmonary phthisis, and he said that he knew of no more certain cause of this disease than profound or prolonged grief or melancholy. In the dairy we often see the variety of grief represented by "Rachel weeping for her children." The maternal instinct is a strongly-marked characteristic in the dairy cow, and, as grief is one of the minor conditions which

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favor the development of tuberculosis in man, it must be allowed as a factor also in the case of the cow.

There is no doubt that nutrition plays as important a role, aetiologically, in the development of tuberculosis as any other single factor outside of the actual presence of the bacillus. Defective nutrition, either from lack of variety, insufficient quantity, or interference with the nutritive functions in any manner, all cause lowered resistance to such an extent as to favor the invasion of tubercular infection. This is true as relating to the human race, and we must give it some weight as a factor in the development of tuberculosis in the lower animals. Owing largely to the cheapness of milk, if the dairyman is to feed his animals with the materials most favorable for nutrition, food must be cheap and stimulating to glandular structures. With rare exceptions do we ever find the cow getting the whole grist of any of the nutritious grains. The materials classified by the dairyman as the best food for cows are the refuse from hominy mills, starch factories, glucose factories, breweries, distilleries, and, in fact, every refuse that is left after working up the nutritious cereals and getting the best out for the nourishment of some other animal. Even on the farms the poorer varieties of hay and grasses

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are always designated as cow food. So we have here at work in the dairy animal another alleged cause of tuberculosis in man.

Phthisis in the human subject is most frequently associated with sedentary occupations. Tailors, seamstresses and other hand workers present more than the usual percentage of deaths from this disease. The same is true of the victims of forced confinement from whatever cause. Baer's statistics of prisons show among the inmates a mortality four times as great as outside. While the average total mortality of phthisis is 15 per cent. of the total mortality of the world at large, in prisons it amounts to 40 or 50 per cent. The mortality of manufacturers is twice as great as that of outside occupations, while the cloisters of the Old World show a phthisis mortality of 50 per cent.

During the winter months the cow is, as a rule, subjected to close and prolonged confinement in an ill-ventilated and foul stable, and if confinement can be considered a factor in the development of the disease in man, it must be reckoned as a factor with the dairy animal. Prolonged lactation is another cause of phthisis in the human subject, but no woman is subjected to so prolonged and continuous lactation as is required of the dairy animal.

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From the time that she is two years of age or under she is milked continuously, with the exception of a few weeks before her parturition; and not only is she milked, but she is pregnant during the greater part of the time that she is yielding her milk. And so we might go on to enumerate other conditions that have been accounted as causes of the disease in the human subject, and we should find them all at work in the dairy and some of them even intensified in the case of the cow. Therefore is it to be wondered at that the cow is a tuberculous animal? And if the disease is contagious and conveyed from one animal to another, what other animal associated with mankind is more likely to convey to him this fell disease? Man is more closely associated with the dairy cow than with any other of his domestic animals. He drinks her milk and eats her flesh, and if she harbors the germ we can see that every condition in her life and her peculiarly high normal temperature, the degree of which is precisely that required for the propagation of this organism as we understand the life history of the tubercle bacillus, favors its transmission. Is it unnatural to suppose that man becomes infected from this animal? And so one of the apparent reasons why man is afflicted with tuberculosis is found as a conse-

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quence of his grave errors in feeding and caring for one of the most useful and numerous of his domesticated animals. Furthermore, I am still convinced of the fact that where the inbred scrofulous cow exists, there tuberculosis in all its forms prevails among the human race, and where this animal is absent the inhabitants enjoy an immunity.

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THE DANGER OF MILK FROM TUBERCULOUS COWS.*

The domesticated bovine animal appears to be, above all other animals, subject to tuberculosis. This animal is capable of bearing the tuberculous processes in their natural state—that is, without breaking down and producing sepsis, which is the cause of death in the disease known variously as phthisis, consumption, and so forth. In other words, a dairy cow will have fulfilled her functions with profit to her owner, and only when she reaches the butcher is it discovered that tuberculous growths are present in various parts of her body. No other animal that I know can be tuberculous for so long a period without exhibiting evidences of the disease, and hence the diagnosis of this disease in the domestic cow is often a very difficult matter.

The reason why the domestic cow bears the tuberculous processes without their breaking down is by reason of her natural bodily tempera-

* Read at the Annual Meeting of the New York State Medical Society, 1892.

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ture, her normal average temperature being 102½°. This I have ascertained from personal observation on hundreds of apparently healthy animals, extending over several years. This is about the temperature that arises in the human subject during the stage of active tuberculization, and this high temperature in the human subject is a prominent etiological factor in the constitutional disturbance, eventuating in the breaking down of the tubercle that leads to the sepsis producing death. Now, this normal temperature of the cow admits of the growth of the tubercle without constitutional disturbance, and consequently the animal's resistance is retained and tuberculous processes attain enormous proportions without affecting the general health or usefulness of the animal. Therefore, in order that a cow may develop the tuberculosis that kills, some other morbid agency (traumatism, puerperal septicaemia, etc.) must supervene to set up the breaking-down process in the tubercle. When acute miliary tuberculosis takes place in the cow, old tuberculous processes are always found, and the temperature is then increased only a degree and a half. Acute miliary tuberculosis in the cow is a comparatively rare disease, and hence many dairymen, cattle-dealers, and breeders imagine that tuberculosis is rare, or

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more rare than is reported to exist in dairy cattle, for this reason alone, or because so few cases die in comparison with the number of animals affected. Therefore, these men do not see the latent evidences of disease, their standard of perfect health in dairy animals being the ability of the animal to perform its functions with profit to its owner; and having no comparative standard of health, they regard the animal as sick only when it refuses to yield milk or fatten for the butcher.

Now, what is the danger of milk from tuberculous cows when used as human food? Of course, an animal affected with acute miliary tuberculosis that kills—and this is the only form of tuberculosis that kills an animal—in this form the milk-secretions are suppressed very soon after the onset of the general infection; and, as the disease is comparatively rare, milk from these animals is not so common as the literature on the subject would lead one to suppose, while the chronic latent form of the disease is always more or less present in the ordinary dairies that supply milk for food; and it is very safe to assume that everyone that drinks milk as it is furnished to cities takes milk from animals affected with tuberculosis—the chronic form always, the acute form occasionally. So the question, as it seems

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to me, should be, When is the human subject fit to take the milk from tuberculous cows with impunity? for there can be little doubt but that in a robust state of health the human being can ingest with impunity the food from tuberculous animals, and probably in many conditions of impaired health such food can be taken without apparent danger. Of course, tuberculosis cannot be studied in the same light as other infectious diseases, because the introduction of the poison into the system to-day may require a year or ten years before it is developed into a disease. It is, therefore, almost utterly impossible for anyone to say in a given case where the infection came from. In the study of this disease, taking isolated or individual cases, where apparent cause and effect stood in close relationship, it is simply a coincidence, and is highly misleading. I have watched the medical literature on the subject very carefully for a number of years, and there are a few cases cited where the evidence pointed strongly to the domestic cow as the direct source of the infection. In other cases, in which I have myself known children brought up on the milk of tuberculous cows, no evil has as yet resulted, and I have never been able to associate any case of tuberculosis in the human subject, infant or adult, directly with a

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tuberculous cow. I know a girl to-day, thirteen years old, whose food for two years after weaning was mainly the milk of a tuberculous cow. The cow, of course, was then affected with chronic tuberculosis, and ultimately succumbed to general infection. The milk was given to this child directly from the cow, and warm, and the child has always been remarkably healthy. About two years ago a friend of mine wanted me to see his cow and say what was the matter with her. I found her suffering from acute pulmonary tuberculosis of the miliary type. She was killed, and we found old tuberculous processes in the mesentery glands. These were not broken down, but a large mass in the mediastinum was broken down, and seemed to be the source from whence the general infection spread. The laryngeal glands were also chronically enlarged. This was a family cow, and furnished three children of the household, aged respectively from two to seven years, with their daily supply of milk. These children, all of remarkably robust health, are perfectly well to-day. But this kind of negative testimony proves no more than the positive testimony that has been thus far accumulated. The disease must be studied, not by isolated cases, but on a broad field. There are some ludicrous instances in the

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history of the disease illustrating the fallacy of drawing deductions from circumscribed observations: "In 1677 twelve students who had taken their repast in the Consistorium of Leipsig, died. At the inquest it was proved that the hotel-keeper had given them, in addition to other food of a bad description, the flesh of emaciated and infected cows, whose viscera were covered with a great number of vesicles, of tubercular nodules, and of purulent tumors. Externally this flesh did not offer any abnormal appearance." In the light of our knowledge in the present day it is safe to assume that, whatever else these students may have died from, it was not simply the tuberculous meat that killed them. Nevertheless this unfortunate accident stirred up an exaggerated public feeling on the continent of Europe, and most countries passed stringent laws. Three years after the Leipsig accident the German States enacted very severe measures to prevent the sale of meat from tuberculous cattle. Butchers were afraid to have anything to do with animals showing the least trace of the disease; the carcasses, and even the instruments used in slaughtering such cattle, were turned over to the public executioner. These measures involved a heavy loss to the cattlemen; and it was found that the executioners did not destroy the dis-

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eased carcasses, but consumed them in their own families or sold them to others, and that no injury resulted from the use of this flesh. Then the pendulum began to swing in the opposite direction, and the medical men began to teach that tuberculosis was not a contagious disease, and that the flesh could be eaten with impunity. In fact, the meat of tuberculous cows was publicly advertised as of good quality. Zuierlioz, a doctor of medicine and philosophy at Bruckenau, took twenty-five pounds of flesh from a tuberculous ox and ate it, in order to show that such meat was not injurious. This doctor also prepared a broth made from the tuberculous nodules of the ox, and drank it in the marketplace before a large number of people. Then about this time the various governments began to rescind the various stringent regulations, and the prejudice against the use of such food ceased to exist. Now, in our day, with the increased knowledge we possess as to the etiology of the disease, stimulating increased discussion and enlarging the literature on the subject, the public are in danger of adopting the same unreasoning prejudice. I say "unreasoning prejudice," not because I underestimate the danger of the presence of tuberculous animals as food-producers, but because the methods heretofore adopted are

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inadequate and one-sided. I firmly believe that all the tuberculosis that afflicts the human race is derived from the domesticated bovine, because the only people on the face of the earth who enjoy immunity from tuberculosis are those who do not harbor domesticated tuberculous animals. If this broad statement is true, what does it signify? Can we control the disease by condemning animals only when they come to the butcher, and allowing the milk to be used until he makes the diagnosis for us? If consumption is a contagious disease, and the human race stands in danger of the contagium coming from their most useful food animals, would it not be wise to regulate the breeding of such animals? There are bovines that are reported to enjoy a total immunity from tuberculosis, and so it is possible for us to produce a breed that will not menace the human race. But until the vast number of earnest workers who are moulding medical and scientific opinion unite their forces in this direction, and until we get an animal not tuberculous, we must use our best efforts to avert the dangers that now threaten us. I do not believe that anybody can tell at what stage of tuberculosis in the cow the milk is safe or becoming dangerous. We have statistical facts enough pointing to the morbid conditions in the

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human subject creating a receptivity to the contagium. We know that nearly 50 per cent. of diabetic subjects are carried off by pulmonary phthisis. Surely we should guard a patient with this disease from the possibility of contagion; also in all other conditions of emaciation and lowered resistance in the adult. With children I have no doubt that the danger is far greater, as their food is solely or chiefly milk. I sincerely believe that a child in perfect health can take the milk of a tuberculous cow with impunity; but a child that is born with a feeble constitution, or of tuberculous parent or parents, or suffering from cachexia, or any of the wasting diseases, should not be allowed to have milk from a tuberculous cow, no matter what stage of the disease may exist in the cow. As to sterilizing or boiling the milk for these children, the process may or may not eliminate the disease germs—and we have pretty good evidence that boiling does not —but we are certain that either process lowers the nutritive value of a food already below par (if from a tuberculous cow) by reason of the diseased condition of the animal itself. So in the same cases where the milk of tuberculous animals is to be prohibited, the absolute necessity of the highest type of food also necessitates the exclusion of boiled or sterilized milk of any kind.

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As all cows are not tuberculous, it is perfectly feasible to select animals to supply infant food. As, however, the chronic forms of tuberculosis in the dairy cow are not easily recognized, the medical man knows little or nothing about the cow; and, as the American veterinary schools have paid less attention than the subject deserves, there are few people who are able to detect the earlier symptoms. The necessity for more definite knowledge of the cow herself by all practitioners is evident, so that when it becomes necessary to prohibit the use of food that is apt to kill, there should be more people able to detect the morbific conditions at work in the food-producing animal. We can safely assert that in our time tuberculosis will not be entirely eliminated from the dairy cow. We are approaching the period when it will be; meanwhile, therefore, let us guard the susceptible, and aid in the advance toward the annihilation of one source of danger to the human race.

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[Reprint from New York Medical Journal, August 14, 1897.]

WHAT MUST WE DO TO BE SAVED FROM TUBERCULOSIS?*

You may remember the story of Paul and Silas: During their missionary work in Thyatira they found a young woman possessed of a spirit of divination; they removed from her this spirit, and thus interfered with her masters, who used her as a means of making money. The apostles were imprisoned for interfering with a commercial enterprise, and while they were in prison an earthquake occurred that destroyed the building, and by this means all the prisoners were released. The jailer in his intense chagrin at the escape of the prisoners, was about to commit suicide when Paul cried out to him, "Do thyself no harm!" and he, knowing that Paul and Silas possessed a knowledge of salvation, said to them, "Sirs, what must I do to be saved?"

Now, in almost the same spirit of missionary enterprise, we are trying to cast out an evil spirit

* Read before the Medical Society of the County of Westchester, N. Y., May, 1897.

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from a bovine female; this female represents a great business interest, and many of the men who own this female do not want us to interfere with their commercial interests, but the people, like the frightened jailer, are calling out to us, "Sirs, what must we do to be saved?" I think it can be safely said that many of us know that our present condition is dangerous. Both by omission and commission we are far from saving grace. The taint of consumption is in us and also in our neat cattle, and in this respect there is no health in us. Therefore the gospel question naturally occurs, What must we do to be saved?

There is a coincident distribution of bacillary tuberculosis in the human and bovine species. This disease can be conveyed from one animal to another. We eat and drink the meat and milk of the dairy cow, and this animal only comes in contact by association with a very small proportion of the human race. In her food she takes nothing that was part of us, while we drink her milk as long as she lives and then devour her body. Each single animal is thus distributed as food to hundreds of the human order. If the disease can be conveyed in food it requires no argument to point out which of these species, the human or bovine, is most dangerous to the other. I have repeatedly stated what I still firmly be-

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lieve, that all the tuberculosis afflicting the human race comes from the dairy cow either directly or remotely, but to avoid argument, it is safe to say that if the dairy cow were not affected with tuberculosis there would be much less of this affliction in the human race. So, to answer the question, we can say, "Cure the bovine race," and this can not be done with the political syringe man. It can only be accomplished by rational hygiene, proper breeding, feeding, and treatment, and when the attempt is made to cure it in this manner many of you will be saved as surely from tuberculosis as Paul and Silas thought the frightened jailer was saved from sin.

In looking back over marked episodes in the history of the human race, one characteristic stands out in bold relief, and that is the tendency of the human family, when some great discovery is made, to go to either extreme and thus delay the enjoyment of the discovered golden mean that lies always between the two extremes.

The history of vaccination is an illustration; so is the development of the common-sense cleanliness into Listerism. In truth, virtue lies between two extremes, and both of these extremes are vices. Between foolhardiness and cowardice there is true courage; between the miser and the spendthrift is the prudent man. Now, there lies

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before us the great and virtuous necessity to eliminate from the bovine race the taint of tuberculosis. This virtuous necessity lies between two extremes; one is to let matters alone, the other is represented by the frantic efforts of State boards to stamp out the disease by killing a few of the animals afflicted, and not attempting to interfere with the conditions that generate the disease. The present effort to stamp out tuberculosis from the dairy cattle of this country is as absurd as it would be to attempt to stay an epidemic of typhoid fever by killing every one who contracted the disease and paying no attention to the source of contagion. I have watched carefully for years the action of State authorities in their attempts to eliminate tuberculosis from the dairy, and I firmly believe that more positive injury has been done by their extreme variance from the proper course than would have resulted from leaving the matter entirely alone. Let me give you an illustration among the many I have observed. I know one dairy that has been visited twice by inspectors with syringe and lymph. This stable has always been positively dirty, ill-ventilated, with poverty and carelessness to make all the other conditions just necessary to develop tuberculosis in an improperly bred animal. The inspectors have killed off their quota of animals

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from this stable and, without hygienic, dietetic, or any other improvement in the environment or care, the owner was simply left poorer, and so forced to buy a lower grade of cows, to fill his denlike place with more tuberculosis. There must be a cause for the large number of cows that are afflicted with tuberculosis, and is it not ordinary plain common-sense to assume that the place to attack the disease is at its fountain head? We all know that close confinement, poor food, prolonged lactation, early and prolific maternity, consanguineous breeding, all or any of these conditions favor the development of bacillary tuberculosis, and all these are the common conditions of the dairy, with the addition of dirt and carelessness. The statute laws of this State and of many others in the Union are sufficient, if honestly and conscientiously enforced, to make a better beginning in stamping out the disease than if ten times the amount of money that had been asked for by the different State boards of health had been granted and put into the hands of the politicians as pay for working the syringe, lymph, and thermometer.

There is no branch of domestic science that has been so studiously neglected as bovine pathology. The term "cow doctor" has always been used among veterinarians as a designation of stupidity.

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When I began the study of bovine medicine I could not find anywhere in the world a text-book giving the correct bovine temperature. The veterinary colleges have kept equine, canine, and even feline pathology up to the times, but the cow in the college has received the same treatment that she has on the farm, been put into the basement to get what nothing else would take—the refuse.

What we want is intelligent bovine veterinarians, men who do not require Koch's doubtful lymph, but those who are possessed of a proper knowledge of the hygienic conditions necessary to insure the health of animals, and to discover the existence of other diseases. Tuberculosis is undoubtedly a devastating scourge to the human race, and it comes largely if not entirely from the bovine race. We can have dairy cows that are not afflicted with it, but not by waiting till they contract the disease, and then killing them. The disease itself will do the killing if it is given time. What we want is doctors who can prevent and thus cure without killing, and such doctors can save thousands of infants' lives by eliminating from the dairy other diseases and conditions that go with tuberculosis in our dairies, but that kill quicker than tuberculosis. This can be largely accomplished without any change in the present

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laws: All that is required is honest and intelligent bovine veterinarians. The spirit which at present seems to animate some dairy inspectors is revealed by the following letter which I quote from the *Medical Review of Reviews:*

"Dr. J. M. O'Neil, of Buffalo, writes to the editor of the *Buffalo Medical Journal* as follows: Sir: I send the following account of some cases which have been brought to my notice, exemplifying the manner in which the bacilli of tuberculosis may be conveyed through the agency of milk. The details of the following cases have been supplied to me by a veterinary inspector, who was engaged in his duties in Cattaraugus county, some sixty miles distant from Buffalo. When there he was requested by a farmer to inspect and test his two herds of cows. He complied with the request, and in the first herd, numbering eighty, he found eight to be infected with tuberculosis, and in the remaining herd he found twenty-five out of a total of thirty animals, infected. A neighboring farmer then asked the inspector to test his herd. He did so and found all healthy. The calves bred from some of the cows were then tested, and it was discovered that many were infected. The owner of the calves gave as a very plausible reason for the infection the fact that he was in the habit of buying skim milk

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and buttermilk, with which to feed the calves, from farmers living in the immediate district, and among others from whom he procured this milk was the farmer whose herd the veterinary inspector had tested and found several of the cows to be suffering from tuberculosis. Of course, the foregoing account only goes further to prove the already well-known fact of the danger of spreading contagion by milk . . . In these particular cases, however, the danger affects Buffalo rather closely, for I also ascertained from the inspector that milk from these diseased herds was daily brought into Buffalo and sold on the streets by peddlers. *The names of the peddlers were, as a matter of course, withheld from me.*"

If it were not sad it would be funny to see a great State like New York paying dairy inspectors to discover the source of milk supply that conveys tuberculosis to calves, and refusing to give the physician the necessary information that would enable him to guard his patients who were in peril from the same source. But, then, this inspector is not called on to kill the babies if they contract the disease, but it means more work for him if the disease is scattered among the herds of cattle in his district. This ridiculous condition of affairs will continue until honest common sense indicates to our health authorities how to attack

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the great danger emanating from the cow stables all over the land. What is the whole foundation of Listerism but cleanliness? If the surgeon of years ago had been told that he was criminally filthy when he carried his instruments in a beautiful-looking, deep-piled, velvet-lined case, and, after opening a malignant abscess or bubo, he simply wiped his instrument, to make the blade bright and prevent it rusting, he would have resented the accusation as a malicious libel. But to-day he could be convicted of criminal carelessness for the same thing by a due process of law. Antisepsis is just plain, common-sense cleanliness. Dirt has been defined as matter in the wrong place. Growing plants thrive and flourish in the presence of material that is foul and noxious to growing animals. There is nothing dirty or filthy when it is in the right place. Cow dung, urine, and effete matter from the lungs and skin will make healthy fodder for the animals that eliminate it when the material is put in the right place under proper conditions. But cow dung plastered over the sides of the cow, or allowed to accumulate in the living place with the animal that drops it, standing constantly in the dung and urine she herself makes, besides fouling the air, gives rise to foot-foul and other painful afflictions that are markedly debilitating; breathing over

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and over again the same air must lead to pulmonary susceptibility to disease; feeding on the refuse matter from distilleries, breweries, glucose and starch factories must tend to nutritive ailments, and all these common conditions of our dairies generate a marked susceptibility to profound constitutional diseases of which tuberculosis is the chief. Many people who are not familiar with the condition of a large number of our dairy stables may imagine that there is some exaggeration in the foregoing statements, but I have never seen any one who, without previous knowledge of the existing conditions, after having made an inspection of a number of dairies furnishing milk for food, has not returned without a profound disgust at the state of affairs. It is not uncommon to find fifteen or twenty cows confined in a damp basement where no effort is made to observe cleanliness, and every effort possible is made to exclude external air during the cold weather, and thus the cows are kept warm by their own reeking breath, made doubly noxious by the accumulating filth and the stench from the refuse food.

The milk from these animals is received in vessels seldom or never properly cleaned, and taken to be bottled or canned into the dwelling-house, where poverty and a natural tendency to shiftless-

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ness make everything as dirty as it is possible to be. I will guarantee to direct anybody to dairies where the foregoing conditions prevail and the milk is sold for infant feeding. Will any reasonable man affirm that the State is doing its whole duty when it sends an inspector to such a stable to kill a few of the cows and do nothing more? The following is the State law that applies to just these cases, and is copied from the Revised Statutes, vol. i, under the head of Dairy Products, sec. 12:

"*The Proper Care of Cows, and using Diseased Milk in Making Articles of Food.*—No person shall keep cows for the productions of milk for market, or for sale or exchange, or for manufacturing the same or cream from the same into articles of food, in a crowded or unhealthy condition, or feed the cows on food that is unhealthy, or that produces impure, unhealthy, diseased, or unwholesome milk. No person shall manufacture from impure, unhealthy, diseased, or unwholesome milk, or of cream from the same, any article of food. Whoever violates the provisions of this section is guilty of a misdemeanor, and shall be punished by a fine of not less than twenty-five dollars nor more than two hundred dollars, or by imprisonment of not less than one month nor more than four months, or by both such fine and imprison-

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ment for the first offense, and by four months' imprisonment for each subsequent offense.

Would it be unreasonable to assert that the enforcement of this section of the statute would do more for the stamping out of tuberculosis than all the efforts that have heretofore been made by State authorities? I have kept pretty close watch of the work being done in this State by the authorities whose duty it is to enforce the laws relating to dairies, and I have yet to see where any one has ever been apprehended for a violation of the above section, and I know that this section of the law is frequently and largely violated. The greatest number of prosecutions has been against the oleomargarine dealers.

This may be proper commercially, but from our point of view, as medical men, it would be of greater benefit to the health of the State to let the imitation butter alone and improve the health of our cattle and the purity of the product derived therefrom.

I have often been asked why I do not bring proceedings against violaters of the law if I know of such cases; but, as I myself keep cows and sell milk, my motives, if I took such action, would be liable to misconstruction. Now, to sum up, what I would recommend, if my opinion were asked, would be, first and foremost, to educate inspec-

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tors to a thorough knowledge of the conditions necessary to breed and feed and care for dairy stock in such a manner that there would be the least possible disease and danger; and then an unbiased enforcement of the law as it exists to-day, turning the commercial supervision into another channel. In fact, the bureau of agriculture of the State of New York takes good care to-day of the commercial interests involved in the dairy business.

For the immediate improvement of our milk supply, I would recommend the formation, in every community, of a society of dairy supervision; this society to be composed of doctors and veterinarians, who will make rules to govern dairies in their vicinity, and who will certify as to the quality of milk supplied to the community by dairy men who are willing to obey and positively carry out the rules of the association. This to be called "approved milk." Probably one of the greatest obstacles to the proper conduct of a dairy is the low price of milk, and if this association of dairy supervision was properly conducted the "approved milk" would command a better price. When milk is produced, as it ought to be, for the health of the community, it must bring a larger price than it commands now.

When it is not possible or advisable to form

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dairy supervisory associations, if our local boards of health, instead of making health codes that are never enforced, would inspect the dairies in their vicinity and, where they found any that were filthy and contained diseased cows, report this to the dairy inspector of their district, and, if the inspector would not perform his duty properly, proceed against him. In this manner the laws as they exist now could be enforced, and thus the dairy cow would become what she should be—a useful and not a dangerous animal.

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COMMENTS.

Regarding the last paper in this latter book, it may not be amiss to print a few comments. Nearly every paper in the series has received some sort of criticism or commendation, but these recent communications will indicate slightly just how the subject is attracting attention.

Philadelphia, Pa., Feb. 7, 1898.

E. F. Brush, M. D.,
Mount Vernon, N. Y.

Dear Doctor.—Your article, " What Must We Do to be Saved from Tuberculosis? " a reprint of which you kindly sent me, is truly science up to date. I congratulate you on your good work.

With best wishes,
Sincerely yours,
J. J. TAYLOR.

Washington, D. C., January 4, 1898.

Dr. E. F. Brush,
Mount Vernon, N. Y.

Dear Sir.—Please accept my thanks for a copy of your little pamphlet entitled " What Must We Do to be Saved from Tuberculosis," reprinted from the New York Medical Journal of August 14, 1897. I have been much interested in the paper, and if you can spare them, I will thank your for two or three additional copies for the

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use of this office. The printed franks which I enclose will bring the pamphlets by mail free of postage.

Very truly yours,
HENRY E. ALVORD,
Chief of Dairy Division.

Port Jervis, N. Y., Jan. 5, 1898.

E. F. Brush, M. D.,
Mount Vernon, N. Y.

Dear Sir.—I am in receipt of your address and am delighted with it. It is the first gleam of common sense that I have seen on the subject coming from your profession, and I thoroughly appreciate it. I should like to publish it in our columns, and if you do not object, I will do so. For that purpose I would need another copy, if you can spare one.

I congratulate you on the paper; it is full of wisdom and it should go in the hands of the State Board of Health and especially of the Tuberculosis Commission—that committee who have done nothing but bleed the taxpayers and breed a senseless scare. I am sincerely obliged to you for the paper and remain,

Yours respectfully,
E. G. FOWLER.

Haughville, Ind., Feb. 15, 1898.

Mr. E. F. Brush, M. D.,

Dear Sir.—I was reading a short piece in the Dairy World, headed, "What Must We Do to

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be Saved from Tuberculosis?" as a title of a pamphlet, and as I am a dairyman, I would like very much to read the little book. Inclosed please find stamp for reply.

Yours truly,

A. E. FRAZEE.

[From the Albany, N. Y., Express, Dec. 28, 1897.]

THE TUBERCULOSIS QUESTION.

"What Must We Do to be Saved From Tuberculosis?" is the title of a paper read by Dr. E. F. Brush, of Mount Vernon, before the Medical society of the county of Westchester, which was published in the New York "Medical Journal" and has now been issued in pamphlet form for general distribution.

Dr. Brush agrees with the State Board of Health in its belief that the prevalence of tuberculosis in human beings in due largely to infection from milk and the meat of cows; but he asserts that the Board is not proceeding in the right manner to eradicate tuberculosis among cattle. He reasons justly that the killing of cattle that are found to be infected can do comparatively little toward the accomplishment of the main purpose while the conditions that breed tuberculosis are allowed to remain. In short, he points out that the State Board of Health does not strike at the root of the evil because it does not adopt measures to prevent the development of the disease.

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Dr. Brush directs attention to the neglect which bovine pathology has suffered. The veterinary colleges have kept the study of equine, canine and even feline pathology up to the times, but the term "cow-doctor" is used among veterinarians as "quack" is used among healers of the human species. Intelligent cow-doctors are needed; men who have a proper knowledge of the hygienic conditions necessary to insure the health of cattle, who can prevent and eliminate tuberculosis from the dairies without wholesale slaughter.

New York, Feb. 28, 1898.

When you can find nothing only the Bible to use to advertise your milk, you are a sorry man, and I will neither countenance your advertising nor your milk in any way.

A. N. Y. M. D.

February 28, 1898.

My Dear Dr. Brush,

I have just read your reprint, "What Must We Do to be Saved From Tuberculosis?" I also read your article in the New York Medical Journal. I feel that you should be encouraged in your work.

Yours sincerely,

W. H. BATES.

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